



JETSKI
watercraft
STX-15F



JET SKI® Watercraft Service Manual



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This quick reference guide will assist you in locating a desired topic or procedure.

- Bend the pages back to match the black tab of the desired chapter number with the black tab on the edge at each table of contents page.
- Refer to the sectional table of contents for the exact pages to locate the specific topic required.



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No liability can be accepted for any inaccuracies or omissions in this publication, although every possible care has been taken to make it as complete and accurate as possible.

The right is reserved to make changes at any time without prior notice and without incurring an obligation to make such changes to products manufactured previously. See your JET SKI[®] watercraft dealer for the latest information on product improvements incorporated after this publication.

All information contained in this publication is based on the latest product information available at the time of publication. Illustrations and photographs in this publication are intended for reference use only and may not depict actual model component parts.

LIST OF ABBREVIATIONS

A	ampere(s)	lb	pound(s)
ABDC	after bottom dead center	m	meter(s)
AC	alternating current	min	minute(s)
ATDC	after top dead center	N	newton(s)
BBDC	before bottom dead center	Pa	pascal(s)
BDC	bottom dead center	PS	horsepower
BTDC	before top dead center	psi	pound(s) per square inch
°C	degree(s) Celsius	r	revolution
DC	direct current	rpm	revolution(s) per minute
F	farad(s)	TDC	top dead center
°F	degree(s) Fahrenheit	TIR	total indicator reading
ft	foot, feet	V	volt(s)
g	gram(s)	W	watt(s)
h	hour(s)	Ω	ohm(s)
L	liter(s)		

Read OWNER'S MANUAL before operating.

MAINTENANCE AND ADJUSTMENTS

Maintenance, replacement, or repair of the emission control devices and systems may be performed by any marine SI engine repair establishment or individual.

EMISSION CONTROL INFORMATION

Fuel Information

THIS ENGINE IS CERTIFIED TO OPERATE ON UNLEADED REGULAR GRADE GASOLINE ONLY.

A minimum of 87 octane of the antiknock index is recommended. The antiknock index is posted on service station pumps.

Emission Control Information

To protect the environment in which we all live, Kawasaki has incorporated an exhaust emission control system in compliance with applicable regulations of the United States Environmental Protection Agency.

Exhaust Emission Control System

This system reduces the amount of pollutants discharged into the atmosphere by the exhaust of this engine. The fuel, ignition and exhaust systems of this engine have been carefully designed and constructed to ensure an efficient engine with low exhaust pollutant levels.

Maintenance

Proper maintenance and repair are necessary to ensure that watercraft will continue to have low emission levels. This Service Manual contains those maintenance and repair recommendations for this engine. Those items identified by the Periodic Maintenance Chart are necessary to ensure compliance with the applicable standards.

Tampering with Emission Control System Prohibited

Federal law prohibits the following acts or the causing thereof: (1) the removal or rendering inoperative by any person other than for purposes of maintenance, repair, or replacement, of any device or element of design incorporated into any new engine for the purposes of emission control prior to its sale or delivery to the ultimate purchaser or while it is in use, or (2) the use of the engine after such device or element of design has been removed or rendered inoperative by any person.

Among those acts presumed to constitute tampering are the acts listed below:

Do not tamper with the original emission related parts.

- * Digital Transistor Ignition System
- * Fuel Pump
- * Spark Plugs
- * Throttle Body and Internal Parts
- * Fuel Injectors
- * ECU

Foreword

This manual is designed primarily for use by trained mechanics in a properly equipped shop. However, it contains enough detail and basic information to make it useful to the owner who desires to perform his own basic maintenance and repair work. A basic knowledge of mechanics, the proper use of tools, and workshop procedures must be understood in order to carry out maintenance and repair satisfactorily. Whenever the owner has insufficient experience or doubts his ability to do the work, all adjustments, maintenance, and repair should be carried out only by qualified mechanics.

In order to perform the work efficiently and to avoid costly mistakes, read the text, thoroughly familiarize yourself with the procedures before starting work, and then do the work carefully in a clean area. Whenever special tools or equipment are specified, do not use makeshift tools or equipment. Precision measurements can only be made if the proper instruments are used, and the use of substitute tools may adversely affect safe operation.

For the duration of the warranty period, we recommend that all repairs and scheduled maintenance be performed in accordance with this service manual. Any owner maintenance or repair procedure not performed in accordance with this manual may void the warranty.

To get the longest life out of your JET SKI® watercraft:

- Follow the Periodic Maintenance Chart in the Service Manual.
- Be alert for problems and non-scheduled maintenance.
- Use proper tools and genuine Kawasaki JET SKI® watercraft parts. Special tools, gauges, and testers that are necessary when servicing Kawasaki JET SKI® watercraft are introduced by the Special Tool Manual. Genuine parts provided as spare parts are listed in the Parts Catalog.

- Follow the procedures in this manual carefully. Don't take shortcuts.
- Remember to keep complete records of maintenance and repair with dates and any new parts installed.

How to Use This Manual

In this manual, the product is divided into its major systems and these systems make up the manual's chapters. The Quick Reference Guide shows you all of the product's system and assists in locating their chapters. Each chapter in turn has its own comprehensive Table of Contents.

For example, if you want ignition coil information, use the Quick Reference Guide to locate the Electrical System chapter. Then, use the Table of Contents on the first page of the chapter to find the Ignition Coil section.

Whenever you see these WARNING and CAUTION symbols, heed their instructions! Always follow safe operating and maintenance practices.

WARNING

This warning symbol identifies special instructions or procedures which, if not correctly followed, could result in personal injury, or loss of life.

CAUTION

This caution symbol identifies special instructions or procedures which, if not strictly observed, could result in damage to or destruction of equipment.

This manual contains four more symbols (in addition to WARNING and CAUTION) which will help you distinguish different types of information.

NOTE

○ *This note symbol indicates points of particular interest for more efficient and convenient operation.*

● Indicates a procedural step or work to be done.

○ Indicates a procedural sub-step or how to do the work of the procedural step it follows. It also precedes the text of a NOTE.

★ Indicates a conditional step or what action to take based on the results of the test or inspection in the procedural step or sub-step it follows.

In most chapters an exploded view illustration of the system components follows the Table of Contents. In these illustrations you will find the instructions indicating which parts require specified tightening torque, oil, grease or a locking agent during assembly.

This model, JT1500A, is mounted with a four-stroke engine.

When the JET SKI® watercraft is submerged and swamped, the four-stroke engine needs special care and systematic procedure for recovery compared with the two-stroke engine. Therefore in this manual, such procedures, which are not shown in SMs for two-stroke engines, are explained thoroughly to cope with the cases.

Refer to the section, After submerging in Chapter 9, Cooling and Bilge Systems for the summary and detailed procedures.

General Information

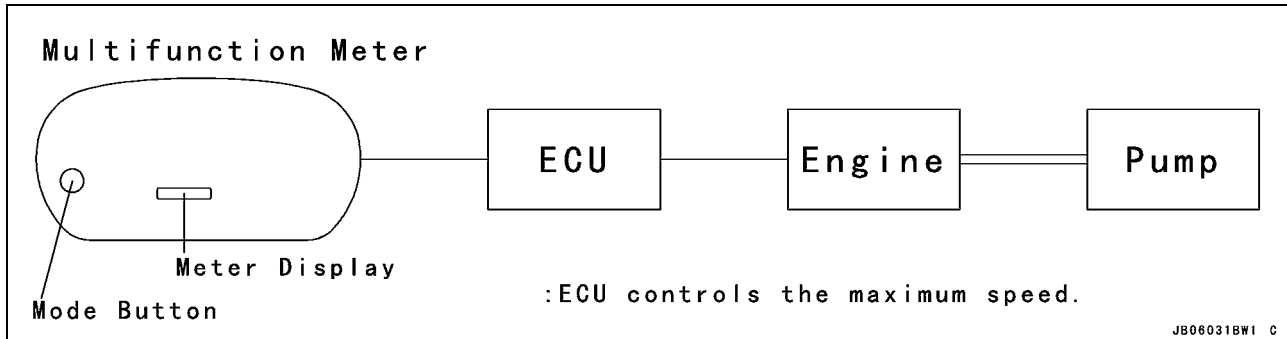
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1-2 GENERAL INFORMATION

Smart Learning Operation mode (SLO) (JT1500-A2 model ~)

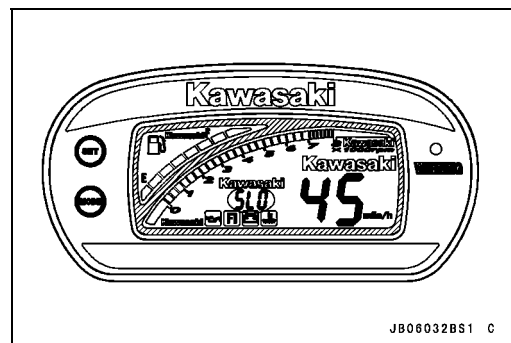
This watercraft is equipped with the Smart Learning Operation mode (SLO) and normal operation mode (Full Power Operation, FPO). The SLO mode reduces the maximum watercraft speed by approximately 30 percent for a use by unskilled operators. To change the SLO mode to FPO mode, and back again, push the "MODE" button for 7 seconds or more.



SLO mode is displayed on the meter as SLO.

NOTE

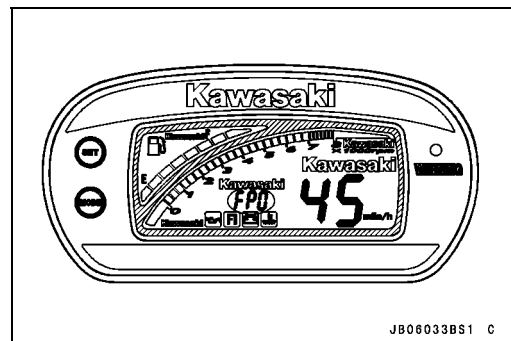
- When shifted to the SLO mode, the initial display, as shown when the ignition switch is turned on, is shown together with a buzzer sound.
- Then, "SLO" is shown blinking at every three seconds.
- Under the SLO mode, all the meter displays and other functions work in the same manner as the normal operation (Full Power Operation, FPO) mode.



Normal operation mode (Full Power Operation mode, FPO) is shown by FPO display.

NOTE

- When shifted to the normal operation mode (Full Power Operation mode, FPO), the same initial display is first shown and followed by "FPO" for two seconds. However, "FPO" is shown only once when shifted and is not displayed thereafter.
- When the ignition switch is turned off and on again, the same mode when turned off is displayed again.



Before Servicing

Before starting to perform an inspection service or carry out a disassembly and reassembly operation on watercraft, read the precautions given below. To facilitate actual operations, notes, illustrations, photographs, cautions, and detailed descriptions have been included in each chapter wherever necessary. This section explains the items that require particular attention during the removal and reinstallation or disassembly and reassembly of general parts.

Especially note the following:

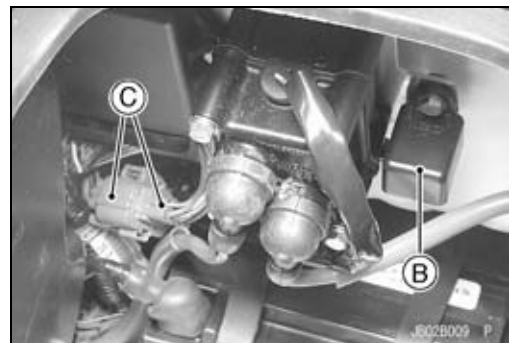
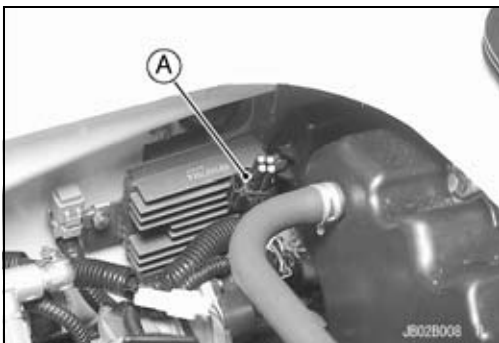
Kawasaki Diagnostic System (KDS) Software

KDS software version 2.2 that runs on Windows personal computer (PC) will be available as a diagnostic tool for watercraft with Kawasaki DFI system.

You need the following items to use the KDS.

Item	P/No.
KDS Software Version 2.2 (CD-ROM)	57001-1503
Signal Converter	57001-1504
Communication Cable and Cable Adapter	57001-1470
Relay Cable	57001-1535

The connectors for the communication cable and relay cable are located in the front of the battery. Connect the communication cable to the KDS connector (4-pin) [A] and the relay cable between the relay assembly [B] connectors (8-pin) [C].



Adjustments

Adjustments shall be made in accordance with the Periodic Maintenance Chart or whenever troubleshooting or presence of symptoms indicate that adjustments may be required. Whenever running of the engine is required during maintenance it is best to have the watercraft in water.

CAUTION
Do not run the engine without cooling water supply for more than 15 seconds, especially in high revolutionary speed or severe engine and exhaust system damage will occur.

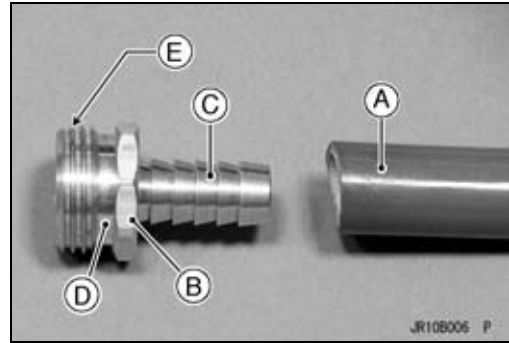
Auxiliary Cooling

An auxiliary cooling supply may be used if the watercraft cannot be operated in water during adjustments. If possible, always operate the watercraft in water rather than use an auxiliary cooling supply.

1-4 GENERAL INFORMATION

Before Servicing

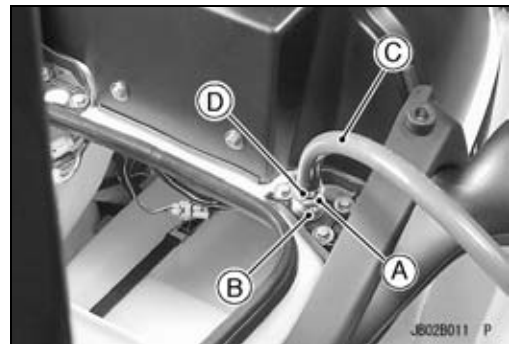
- Obtain a standard garden hose [A] and a garden hose adapter [B] as shown.
 - C: Garden Hose Fitting of Adapter
 - D: Flushing Fitting of Adapter
 - E: Thread: Rp 3/4
- Optional part (P/No. 92005-3746) is available as a garden hose adapter.



- Open the front storage compartment cover.
- Remove the flushing cap [A] on the brim of the storage compartment.



- Screw a garden hose adapter [A] onto the flushing fitting [B].
- Attach a garden hose [C] to a garden hose adapter and secure the hose clamp [D].



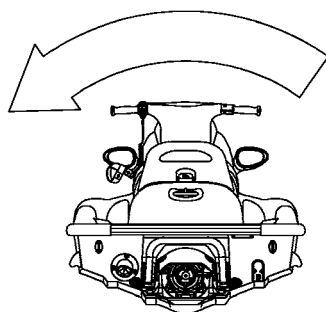
- Attach the garden hose to a faucet. Do not turn on the water until the engine is running and turn it off immediately when the engine stops. The engine requires 2.4 L/min (2.5 qts/min) at 1 800 rpm and 7.0 L/min (7.4 qts/min) at 6 000 rpm.

CAUTION

Insufficient cooling supply will cause the engine and/or exhaust system to overheat and severe damage will occur. Excessive cooling supply may kill the engine and flood the cylinders, causing hydraulic lock. Hydraulic lock will cause severe damage to the engine. If the engine dies while using an auxiliary cooling supply, the water must be shut off immediately.

CAUTION

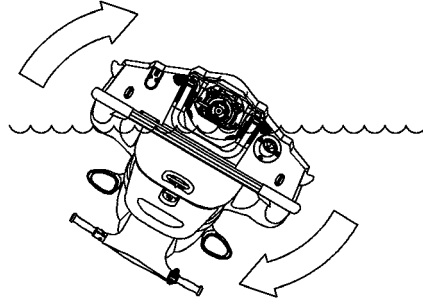
Always turn the boat on its left side. Rolling to the right side can cause water in the exhaust system to run into the engine, with possible engine damage.



Before Servicing

CAUTION

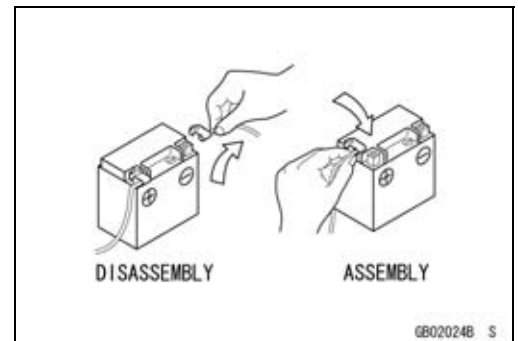
Turn the capsized boat clockwise so that the port side always faces downward. Turning counterclockwise can cause water in the exhaust system to run into the engine, with possible engine damage.



JB02007BW1 C

Battery Ground

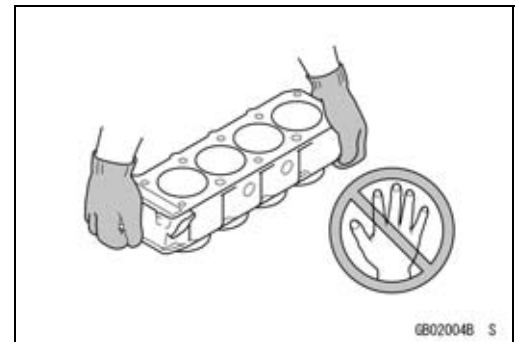
Before completing any service on the watercraft, disconnect the battery wires from the battery to prevent the engine from accidentally turning over. Disconnect the ground wire (–) first and then the positive (+). When completed with the service, first connect the positive (+) wire to the positive (+) terminal of the battery then the negative (–) wire to the negative terminal.



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Edges of Parts

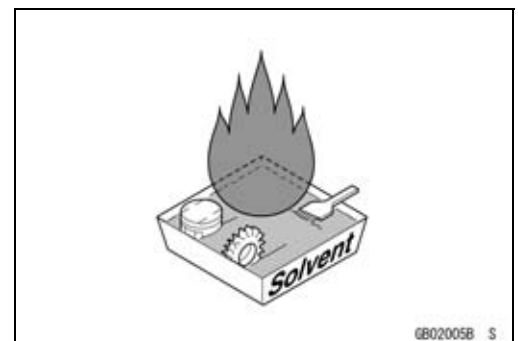
Lift large or heavy parts wearing gloves to prevent injury from possible sharp edges on the parts.



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Solvent

Use a high flash point solvent when cleaning parts. High flash point solvent should be used according to directions of the solvent manufacturer.



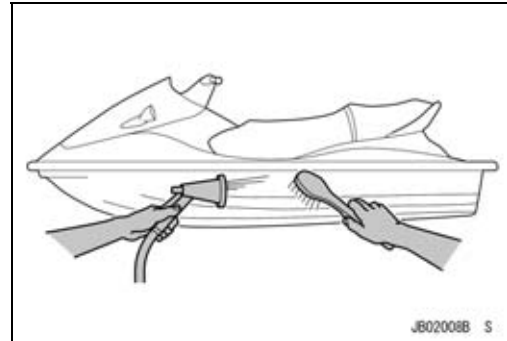
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1-6 GENERAL INFORMATION

Before Servicing

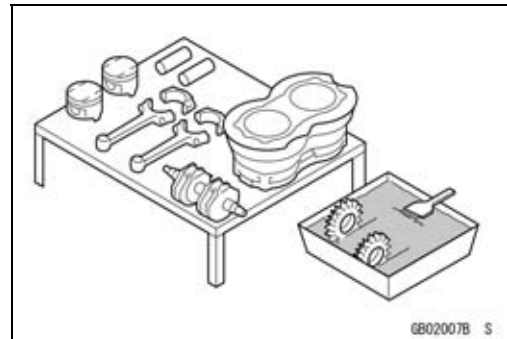
Cleaning Watercraft before Disassembly

Clean the watercraft thoroughly before disassembly. Dirt or other foreign materials entering into sealed areas during watercraft disassembly can cause excessive wear and decrease performance of the watercraft.



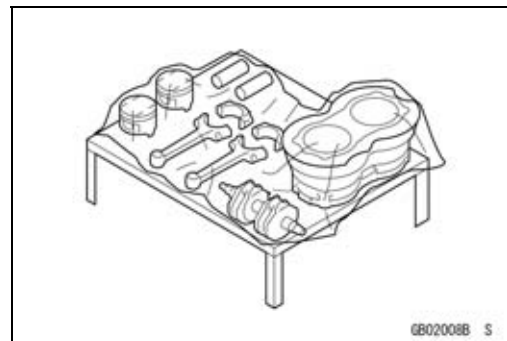
Arrangement and Cleaning of Removed Parts

Disassembled parts are easy to confuse. Arrange the parts according to the order the parts were disassembled and clean the parts in order prior to assembly.



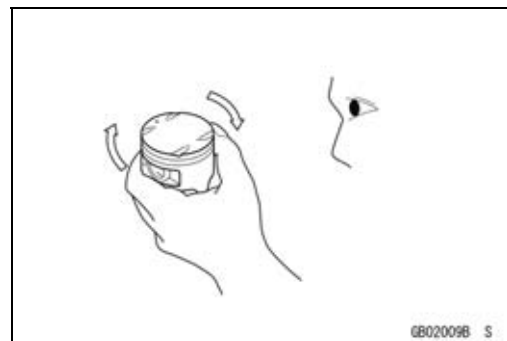
Storage of Removed Parts

After all the parts including subassembly parts have been cleaned, store the parts in a clean area. Put a clean cloth or plastic sheet over the parts to protect from any foreign materials that may collect before re-assembly.



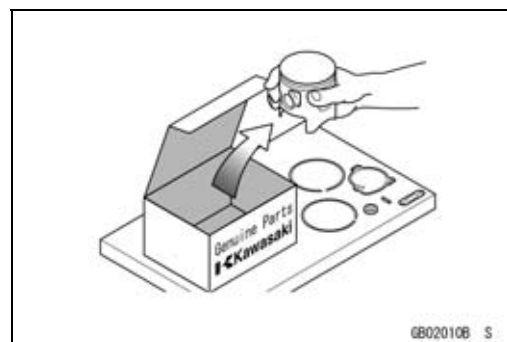
Inspection

Reuse of worn or damaged parts may lead to serious accident. Visually inspect removed parts for corrosion, discoloration, or other damage. Refer to the appropriate sections of this manual for service limits on individual parts. Replace the parts if any damage has been found or if the part is beyond its service limit.



Replacement Parts

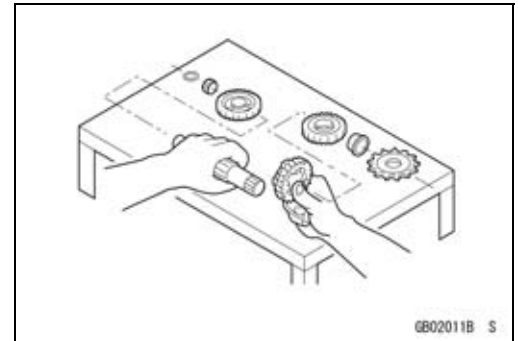
Replacement Parts must be KAWASAKI genuine or recommended by KAWASAKI. Gaskets, O-rings, Oil seals, Grease seals, circlips or cotter pins must be replaced with new ones whenever disassembled.



Before Servicing

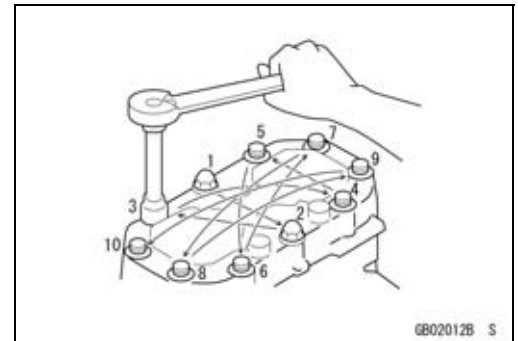
Assembly Order

In most cases assembly order is the reverse of disassembly, however, if assembly order is provided in this Service Manual, follow the procedures given.



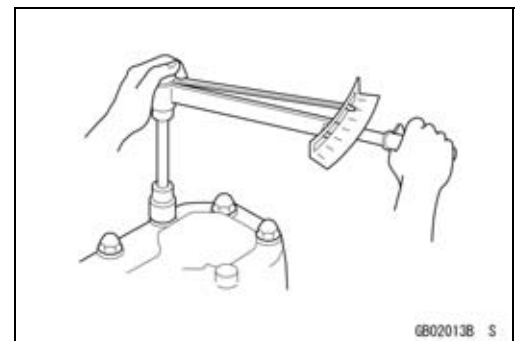
Tightening Sequence

Generally, when installing a part with several bolts, nuts, or screws, start them all in their holes and tighten them to a snug fit. Then tighten them according to the specified sequence to prevent case warpage or deformation which can lead to malfunction. Conversely when loosening the bolts, nuts, or screws, first loosen all of them by about a quarter turn and then remove them. If the specified tightening sequence is not indicated, tighten the fasteners alternating diagonally.



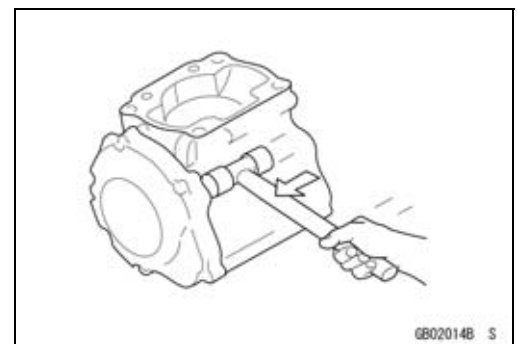
Tightening Torque

Incorrect torque applied to a bolt, nut, or screw may lead to serious damage. Tighten fasteners to the specified torque using a good quality torque wrench.



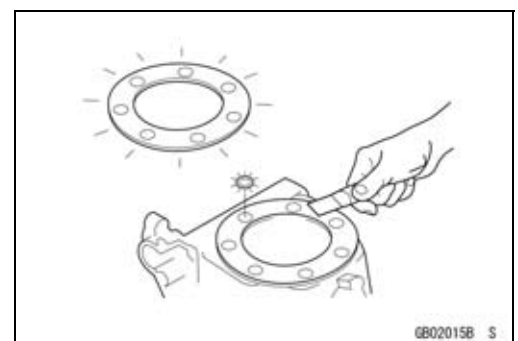
Force

Use common sense during disassembly and assembly, excessive force can cause expensive or hard to repair damage. When necessary, remove screws that have a non-permanent locking agent applied using an impact driver. Use a plastic-faced mallet whenever tapping is necessary.



Gasket, O-ring

Hardening, shrinkage, or damage of both gaskets and O-rings after disassembly can reduce sealing performance. Remove old gaskets and clean the sealing surfaces thoroughly so that no gasket material or other material remains. Install new gaskets and replace used O-rings when re-assembling

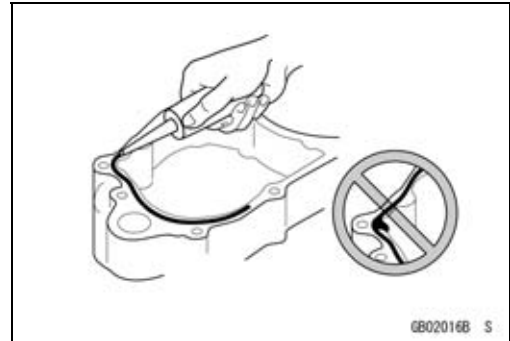


1-8 GENERAL INFORMATION

Before Servicing

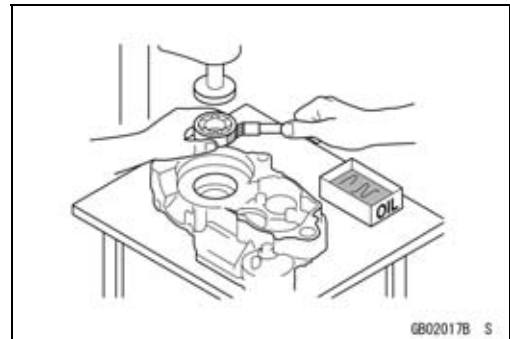
Liquid Gasket, Locking Agent

For applications that require Liquid Gasket or a Locking agent, clean the surfaces so that no oil residue remains before applying liquid gasket or locking agent. Do not apply them excessively. Excessive application can clog oil passages and cause serious damage.



Press

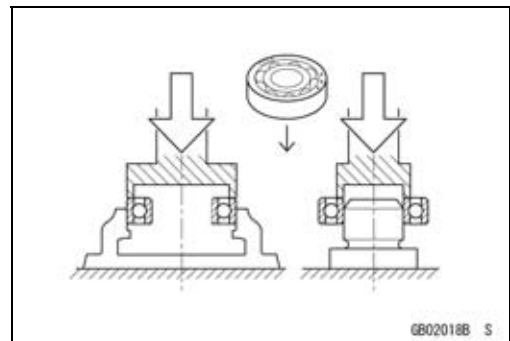
For items such as bearings or oil seals that must be pressed into place, apply small amount of oil to the contact area. Be sure to maintain proper alignment and use smooth movements when installing.



Ball Bearing

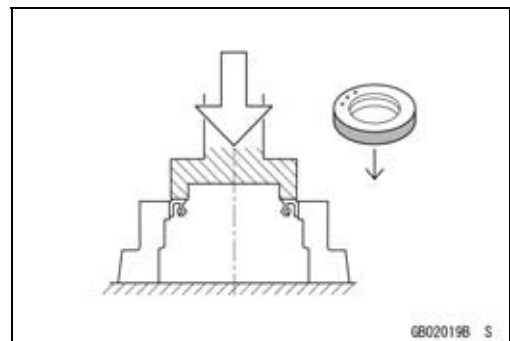
Do not remove pressed ball or needle unless removal is absolutely necessary. Replace with new ones whenever removed. Press bearings with the manufacturer and size marks facing out. Press the bearing into place by putting pressure on the correct bearing race as shown.

Pressing the incorrect race can cause pressure between the inner and outer race and result in bearing damage.

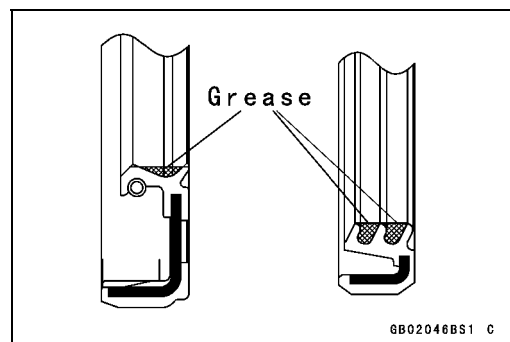


Oil Seal, Grease Seal

Do not remove pressed oil or grease seals unless removal is necessary. Replace with new ones whenever removed. Press new oil seals with manufacture and size marks facing out. Make sure the seal is aligned properly when installing.



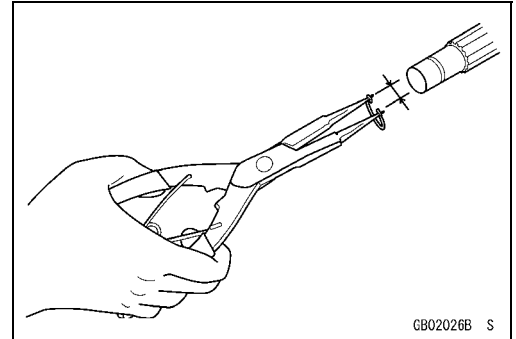
Apply specified grease to the lip of seal before installing the seal.



Before Servicing

Circlips, Cotter Pins

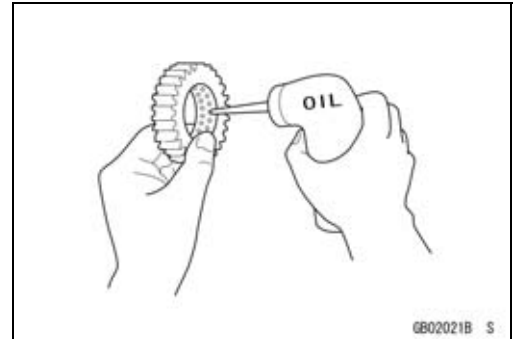
Replace circlips or cotter pins that were removed with new ones. Take care not to open the clip excessively when installing to prevent deformation.



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Lubrication

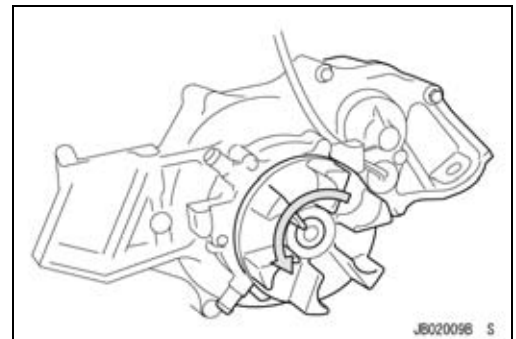
It is important to lubricate rotating or sliding parts during assembly to minimize wear during initial operation. Lubrication points are called out throughout this manual, apply the specific oil or grease as specified.



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Direction of Engine Rotation

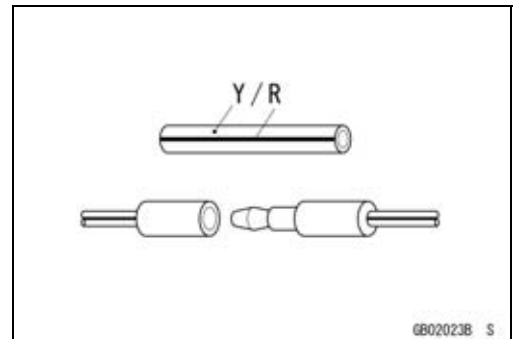
When rotating the crankshaft, by hand, the free play amount of rotating direction will affect the adjustment. Rotate the crankshaft to positive direction (counter-clockwise viewed from stern side).



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Electrical Wires

A two-color wire is identified first by the primary color and then the stripe color. Unless instructed otherwise, electrical wires must be connected to those of the same color.



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1-10 GENERAL INFORMATION

Model Identification

JT1500-A1 Left Side View



JT1500-A1 Right Side View



General Specifications

Items	JT1500-A1 ~ A2
Engine Type Displacement Bore and Stroke Compression Ratio Maximum Horsepower Maximum Torque Ignition System Lubrication System Carburetion System Starting System Cylinder Numbering Method Firing Order Valve Timing: Inlet: Open Close Duration Exhaust: Open Close Duration	4-stroke, DOHC, 4-cylinder, water cooled 1 498 mL (91.4 cu in.) 83 × 69.2 mm (3.27 × 2.72 in.) 10.6 : 1 118 kW (160 PS) @7 500 r/min (rpm) 152 N·m (15.5 kgf·m, 112.1 ft·lb) @7 250 r/min (rpm) Digital transistor Forced lubrication (semi-dry sump) FI (fuel injection) MIKUNI AC 60 × 1 Electric starter Front (bow) to rear (stern), 1-2-3-4 1-2-4-3 22.5° BTDC 67.5° ABDC 270° 74.5° BBDC 9.5° ATDC 264°
Tuning Specifications Spark plug: Type Gap Ignition Timing Idle Speed Compression Pressure	NGK CR9EK 0.7 ~ 0.8 mm (0.028 ~ 0.031 in.) 3° ATDC @1 300 r/min ~ 32° BTDC @3 000 r/min (rpm) 1 300 ±100 r/min (rpm) -in water 1 300 ±100 r/min (rpm) -out of water 1 190 ~ 1 799 kPa (12.1 ~ 18.3 kgf/cm ² , 173 ~ 261 psi) @430 r/min (rpm)
Drive System Coupling Jet Pump: Type Thrust Steering Braking	Direct drive from engine Axial flow single stage 4 250 N (434 kgf, 955 lb) Steerable nozzle Water drag
Performance †Minimum Turning Radius †Fuel Consumption †Cruising Range	4.0 m (13.1 ft) 43 L/h (11.4 US gal/h) @full throttle 134 km (87 mile) @full throttle 1 hour and 26 minutes (3 person)
Dimensions Overall Length	3 120 mm (122.8 in.)

1-12 GENERAL INFORMATION

General Specifications

Items	JT1500-A1 ~ A2
Overall Width	1 180 mm (46.5 in.)
Overall Height	1 050 mm (41.3 in.)
Dry Weight	338 kg (745 lb)
Fuel Tank Capacity	62 L (16.4 US gal)
Engine Oil	
Type	API SE, SF or SG API SH or SJ with JASO MA
Viscosity	SAE 10W-40
Capacity	5.0 L (5.3 US qt)
Electrical Equipment	
Battery	12 V 18 Ah
Maximum Generator Output	16 A @14 V

†: This information shown here represents results under controlled conditions, and the information may not be correct under other conditions.

Specifications subject to change without notice, and may not apply to every country.

Unit Conversion Table

Prefixes for Units

Prefix	Symbol	Power
mega	M	× 1 000 000
kilo	k	× 1 000
centi	c	× 0.01
milli	m	× 0.001
micro	μ	× 0.000001

Units of Mass

kg	×	2.205	=	lb
g	×	0.03527	=	oz

Units of Volume

L	×	0.2642	=	gal (US)
L	×	0.2200	=	gal (imp)
L	×	1.057	=	qt (US)
L	×	0.8799	=	qt (imp)
L	×	2.113	=	pint (US)
L	×	1.816	=	pint (imp)
mL	×	0.03381	=	oz (US)
mL	×	0.02816	=	oz (imp)
mL	×	0.06102	=	cu in

Units of Force

N	×	0.1020	=	kg
N	×	0.2248	=	lb
kg	×	9.807	=	N
kg	×	2.205	=	lb

Units of Length

km	×	0.6214	=	mile
m	×	3.281	=	ft
mm	×	0.03937	=	in.

Units of Torque

N·m	×	0.1020	=	kgf·m
N·m	×	0.7376	=	ft·lb
N·m	×	8.851	=	in·lb
kgf·m	×	9.807	=	N·m
kgf·m	×	7.233	=	ft·lb
kgf·m	×	86.80	=	in·lb

Units of Pressure

kPa	×	0.01020	=	kgf/cm ²
kPa	×	0.1450	=	psi
kPa	×	0.7501	=	cmHg
kgf/cm ²	×	98.07	=	kPa
kgf/cm ²	×	14.22	=	psi
cmHg	×	1.333	=	kPa

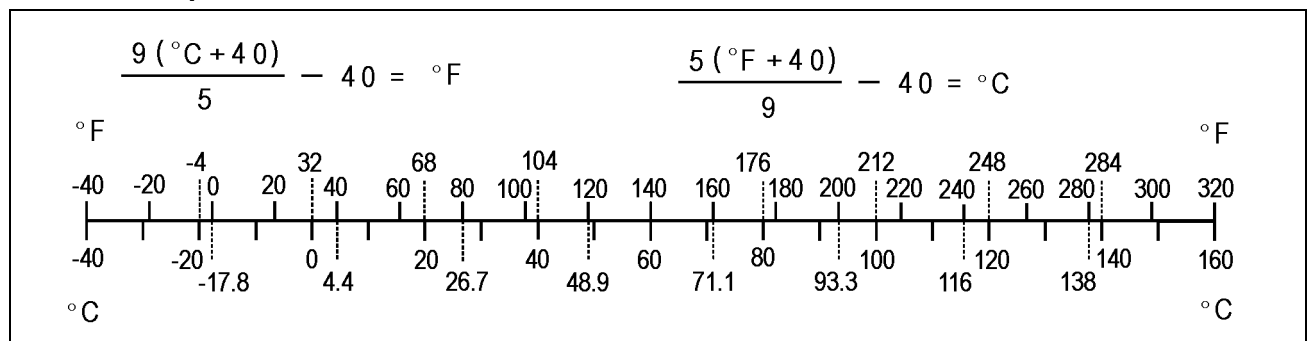
Units of Speed

km/h	×	0.6214	=	mph
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Units of Power

kW	×	1.360	=	PS
kW	×	1.341	=	HP
PS	×	0.7355	=	kW
PS	×	0.9863	=	HP

Units of Temperature



Periodic Maintenance

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2-2 PERIODIC MAINTENANCE

Periodic Maintenance Chart

The scheduled maintenance must be done in accordance with this chart to keep the watercraft in good running condition. **The initial maintenance is vitally important and must not be neglected.**

Description	Frequency	Initial 10 Hours	Every 25 Hours	Every 50 Hours	Every 100 Hours	Reference
Inspect throttle control system (e)			•			2-10
Inspect/clean air filter drain caps			•			2-10
Inspect/clean air filter				• (or every year)		2-11
Inspect fuel vent check valve			•			2-11
Clean fuel pump screen (e)			•			2-12
Inspect throttle shaft spring (replace throttle body if necessary) (e)					•	2-12
Replace engine oil				• (or every year)		2-12
Replace engine oil filter					•	2-14
Check air suction valve					•	2-15
Inspect/adjust valve clearance (e)					•	2-15
Inspect/tighten engine mounting bolts				• (or every year)		2-19
Inspect/replace coupling damper					•	2-19
Flush cooling system (after each use in salt water)			•			2-19
Flush bilge line and filter			•			2-21
Inspect impeller blades for damage (remove)					•	2-22
Inspect steering cable/shift cable					•	2-22
Lubricate handlebar pivot (disassemble)			•			2-22
Inspect hull drain screws (replace if necessary)				•		2-23
Inspect battery charging condition			•			2-23
Inspect battery terminals			•			2-23
Clean and gap spark plugs (replace if necessary) (e)			•			2-24
Lubricate throttle cable fitting at throttle body			•			2-24
Lubricate throttle cable and throttle fitting at throttle case			•			2-24
Lubricate steering cable/shift cable ball joints and steering nozzle/reverse bucket pivots			•			2-24
Check all hoses, hose clamps, nuts, bolts, and fasteners		•	•			2-27

(e): Emission Related Items

Torque and Locking Agent

The following table list the tightening torque for the major fasteners, and the parts requiring use of a non-permanent locking agent or silicone sealant.

Letters used in the “Remarks” column mean:

EO: Apply oil to the threads and seating surface.

L: Apply a non-permanent locking agent to the threads.

MO: Apply molybdenum disulfide grease oil solution.

R: Replacement Part

S: Tighten the fasteners following the specified sequence.

SS: Apply silicone sealant to the threads.

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Fuel System				
Vehicle-down Sensor Mounting Screws	1.5	0.15	13 in·lb	
Bracket Mounting Bolts	–	–	–	L
Inlet Manifold Mounting Bolts	25	2.5	18	L
Inlet Manifold Mounting Nuts	20	2.0	14	
Delivery Pipe Mounting Bolts	7.8	0.80	69 in·lb	
Inlet Air Pressure Sensor Bolts	7.8	0.80	69 in·lb	
Throttle Cable Holder Bolts	8.8	0.90	78 in·lb	L
Inlet Air Temperature Sensor	20	2.0	14	
Throttle Body Assy Mounting Bolts	20	2.0	14	
Inlet Manifold Drain Plug	20	2.0	14	
Inlet Manifold Plate Bolts	7.8	0.80	69 in·lb	
Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
Camshaft Position Sensor Bolt	7.8	0.80	69 in·lb	L
Oil Temperature Sensor	15	1.5	11	see text
Water Temperature Sensor	15	1.5	11	see text
Regulator/Rectifier Bolts	7.8	0.80	69 in·lb	
ECU Mounting Bolts	8.8	0.90	78 in·lb	L
Throttle Sensor Mounting Screws	2.0	0.20	18 in·lb	
ISC Actuator Mounting Bolts	4.9	0.50	43 in·lb	
Oil Pressure Switch	15	1.5	11	SS
Fuel Filler Tube Clamp Screws	2.9	0.30	26 in·lb	
Fuel Level Sensor Clamp Screw	2.9	0.30	26 in·lb	
Fuel Filter Mounting Bolts	8.8	0.90	78 in·lb	L
Air Filter Mounting Bolts	9.8	1.0	87 in·lb	
Air Filter Bracket Mounting Bolts	7.8	0.80	69 in·lb	L
Throttle Cable Locknut	7.8	0.80	69 in·lb	
Throttle Case Mounting Screws	3.9	0.40	35 in·lb	
Engine Lubrication System				
Breather Plate Bolts	7.8	0.80	69 in·lb	
Oil Filler Cap	1.0	0.10	8.7 in·lb	
Oil Passage Plugs	20	2.0	14	L
Oil Separator Tank Mounting Screws	4.9	0.50	43 in·lb	L
Breather Case Mounting Bolts	7.8	0.80	69 in·lb	
Breather Pipe Bolts	8.8	0.90	78 in·lb	

2-4 PERIODIC MAINTENANCE

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Oil Passage Joints	11	1.1	95 in·lb	L
Oil Cooler Assembly Bolts	7.8	0.80	69 in·lb	
Oil Pressure Switch	15	1.5	11	SS
Oil Passage Bolt	78	8.0	58	S
Oil Filter	18	1.8	13	EO
Oil Cooler Positioning Bolt	20	2.0	14	S
Oil Pan Bolts	7.8	0.80	69 in·lb	S
Dipstick Tube Bolts	7.8	0.80	69 in·lb	L, S
Oil Pump Sprocket Bolt	15	1.5	11	L
Oil Pump Cover Bolts	7.8	0.80	69 in·lb	
Oil Pressure Relief Valve	15	1.5	11	L
Oil Pipe Bolts	7.8	0.80	69 in·lb	
Chain Guide Spring Plate Bolt	7.8	0.80	69 in·lb	
Oil Pump Body Plug	20	2.0	14	L
Oil Pump Body Bolts	7.8	0.80	69 in·lb	
Oil Screen Bolts	7.8	0.80	69 in·lb	
Water Pipe Joints	20	2.0	14	L
Exhaust System				
Exhaust Manifold Mounting Nuts	25	2.5	18	S
Exhaust Manifold Mounting Bolts	25	2.5	18	L, S
Bypass Nozzle	–	–	–	L
Flushing Hose Joint	11	1.1	95 in·lb	SS
Water Hose Joint	11	1.1	95 in·lb	SS
Water Temperature Sensor	15	1.5	11	see chapter 3
Exhaust Pipe Mounting Plate Bolts	30	3.0	22	L
Exhaust Pipe Mounting Bolts	30	3.0	22	
Engine Top End				
Air Suction Valve Cover Bolts	9.8	1.0	87 in·lb	
Cylinder Head Cover Bolts	9.8	1.0	87 in·lb	
Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
Camshaft Cap Bolts	12	1.2	104 in·lb	S
Cylinder Head Bolts (M7)	20	2.0	14	S
Cylinder Head Bolts (M11)	23	2.3	17	First, MO, S
Cylinder Head Bolts (M11)	59	6.0	43	Final, MO, S
Water Jacket Plugs	20	2.0	14	L
Cylinder Head Bolts (M6)	12	1.2	104 in·lb	S
Engine Hook Bolts	20	2.0	14	
Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
Exhaust Side Camshaft Chain Guide Bolts (Upper)	25	2.5	18	
Exhaust Side Camshaft Chain Guide Bolts (Lower)	12	1.2	104 in·lb	
Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Inlet Side Camshaft Chain Guide Bolts	12	1.2	104 in·lb	L
Camshaft Chain Tensioner Mounting Bolts	9.8	1.0	87 in·lb	L
Camshaft Chain Tensioner Cap Bolt	20	2.0	14	
Camshaft Position Sensor Rotor Bolt	12	1.2	104 in·lb	L
Water Hose Joint	11	1.1	95 in·lb	SS
Oil Passage Joint	11	1.1	95 in·lb	L
Engine Removal/Installation				
Engine Mounting Bolts	36	3.7	27	L
Engine Damper Mounting Bolts	16	1.6	12	L
Engine Bottom End				
Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
Engine Bracket Mounting Bolts	29	3.0	22	L
Timing Rotor Bolt	29	3.0	22	L
Connecting Rod Nuts	–	–	–	MO, see text
Oil Passage Plugs	20	2.0	14	L
Stator Mounting Bolts	12	1.2	104 in·lb	L
Grommet Cover Bolts	9.8	1.0	87 in·lb	L
Magneto Cover Bolts	20	2.0	14	
Output Cover Bolts	7.8	0.80	69 in·lb	
Output Shaft	245	25	180	MO
Coupling	98	10	72	
Crankcase Bolts (M10)	50	5.0	36	MO, S
Crankcase Bolts (M8)	29	3.0	22	MO, S
Crankcase Bolts (M8)	29	3.0	22	S
Crankcase Bolts (M6)	12	1.2	104 in·lb	S
Cooling and Bilge Systems				
Breather Mounting Bolt	–	–	–	L
Water Hose Joint (L Shape Type)	11	1.1	95 in·lb	SS
Water Hose Joint (Straight Shape Type)	20	2.0	14	SS
Water Hose Joint (Straight Shape Type)	11	1.1	95 in·lb	SS, see text
Drive System				
Coupling	39	4.0	29	L
Drive Shaft Holder Mounting Bolts	22	2.2	16	L
Coupling Cover Bolts	8.8	0.90	78 in·lb	L
Pump and Impeller				
Steering Nozzle Pivot Bolts	19	1.9	14	L
Pump Mounting Bolts	36	3.7	27	L
Pump Outlet Mounting Bolts	19	1.9	14	L
Pump Cap Bolts	9.8	1.0	87 in·lb	L
Pump Cap Plug	3.9	0.40	35 in·lb	
Impeller	98	10	72	
Pump Bracket Mounting Bolts (2)	19	1.9	14	L, SS
Pump Bracket Mounting Bolts (4)	9.8	1.0	87 in·lb	L

2-6 PERIODIC MAINTENANCE

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Pump Cover Mounting Bolts	7.9	0.80	69 in·lb	L
Grate Mounting Bolts	9.8	1.0	87 in·lb	L
Filter Cover Mounting Bolts	9.8	1.0	87 in·lb	L
Steering				
Handlebar Clamp Bolts	16	1.6	12	L
Start/stop Switch Case Mounting Screws	3.9	0.40	35 in·lb	
Throttle Case Mounting Screws	3.9	0.40	35 in·lb	
Steering Shaft Locknut	49 ~ 59	5.0 ~ 6.0	36 ~ 43	
Steering Shaft Nut	–	–	–	Hand-Tight
Steering Holder Mounting Bolts	20	2.0	14.5	L
Steering Neck Mounting Bolts	16	1.6	12	L
Steering Cable Joint Bolt	9.8	1.0	87 in·lb	L
Ball Joint	9.8	1.0	87 in·lb	L
Shift Cable End Nut	9.8	1.0	87 in·lb	
Reverse Bucket Pivot Bolts	19	1.9	14	L
Shift Cable Nut	39	4.0	29	
Steering Cable Nut	39	4.0	29	
Shift Lever Locknut	20	2.0	14.5	
Hull/Engine Hood				
Crossmember Bolts	7.8	0.80	69 in·lb	L
Handrail Bolts	9.8	1.0	87 in·lb	L
Lock Assembly Nut	4.9	0.50	43 in·lb	
Front Duct Bolts	–	–	–	L
Damper Bolts	–	–	–	L
Damper Bracket Bolts	–	–	–	L
Front Storage Compartment Cover Bolts	–	–	–	L
Hinge Bolts	–	–	–	L
Front Storage Compartment Hook Bolts	–	–	–	L
Steering Cover Bolts	–	–	–	L
Meter Screen Bolts	–	–	–	L
Seat Hook Bolts	–	–	–	L
Seat Locknut	–	–	–	L
Reboarding Step Bolts	–	–	–	L
Mirror Stay Bolts	–	–	–	L
Stabilizer Bolts	9.8	1.0	87 in·lb	L
Air inlet Duct Bolts	–	–	–	L
Exhaust Outlet Bolts	–	–	–	L
Electrical System				
Vehicle-Down Sensor Mounting Screws	1.5	0.15	13 in·lb	
Electrical Parts Bracket Screws	4.9	0.50	43 in·lb	L
Starter Relay Case Bolts	7.8	0.80	69 in·lb	
Ignition Coil Mounting Bolts	8.8	0.90	78 in·lb	L
Water Temperature Sensor	15	1.5	11	see text

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Starter Relay Mounting Nut	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
Starter Cable Mounting Nut	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
Timing Rotor Bolt	20	2.0	14	L
Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
Rubber Grommet Holder Screws	4.4	0.45	39 in·lb	L
Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
Oil Temperature Sensor	15	1.5	11	see text
Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
Spark Plugs	13	1.3	113 in·lb	
Regulator/rectifier Bolts	7.8	0.80	69 in·lb	
Replay Assembly Bolts	2.5	0.25	22 in·lb	L
ECU Mounting Bolts	8.8	0.90	78 in·lb	L
Main Fuse Mounting Bracket Bolt	7.8	0.80	69 in·lb	
Multifunction Meter Mounting Bolts	3.9	0.40	35 in·lb	L
Fuel Level Sensor Clamp Screw	2.9	0.30	26 in·lb	
Start/stop Switch Case Mounting Screws	3.9	0.40	35 in·lb	
Speed Sensor Mounting Bolts	3.9	0.40	35 in·lb	L
Starter Motor Through Bolts	6.4	0.65	56 in·lb	L, R
Starter Motor Mounting Bolts	8.8	0.90	78 in·lb	L
Starter Motor Ground Bolt	7.8	0.80	69 in·lb	
Starter Motor Terminal Nut	7.8	0.80	69 in·lb	
Stator Coil Bolts	12	1.2	104 in·lb	L
Grommet Holder Bolts	8.8	0.90	78 in·lb	L

The next table, relating tightening torque to thread diameter, lists the basic torque for the bolts and nuts. Use this table for only the bolts and nuts which do not require a specific torque value. All of the values are for use with dry solvent-cleaned threads.

General Fasteners (stainless bolt and nut)

Threads dia. (mm)	Torque		
	N·m	kgf·m	ft·lb
6	5.9 ~ 8.8	0.60 ~ 0.90	52 ~ 78 in·lb
8	16 ~ 22	1.6 ~ 2.2	12 ~ 16
10	30 ~ 41	3.1 ~ 4.2	22 ~ 30

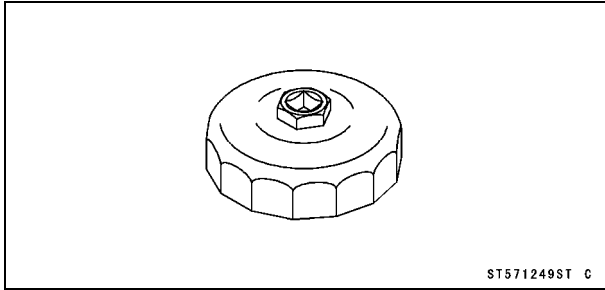
2-8 PERIODIC MAINTENANCE

Specifications

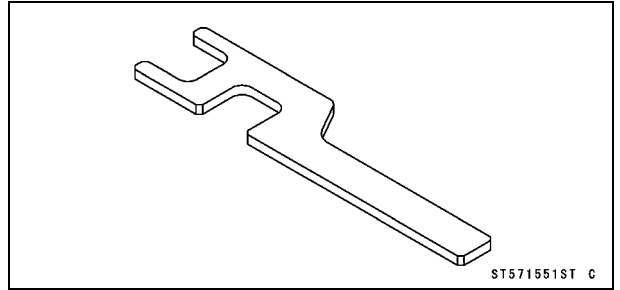
Item	Standard	Service Limit
Fuel System Throttle Lever Free Play	about 2 mm (0.08 in.)	— — —
Engine Lubrication System Engine Oil: Type	API SE, SF or SG API SH or SJ with JASO MA	— — —
Viscosity	SAE 10W-40	— — —
Capacity	4.0 L (4.2 US qt, with or without the filter) 5.0 L (5.3 US qt, when engine is completely dry)	— — —
Engine Top End Valve Clearance: IN	0.15 ~ 0.24 mm (0.0059 ~ 0.0094 in.)	— — —
EX	0.22 ~ 0.31 mm (0.0087 ~ 0.0122 in.)	— — —
Electrical System Spark Plug Gap	0.7 ~ 0.8 mm (0.028 ~ 0.031 in.)	— — —

Special Tools and Sealant

**Oil Filter Wrench:
57001-1249**



**Shaft Wrench:
57001-1551**



2-10 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Fuel System

Throttle Control System Inspection

- Inspect the throttle lever free play [A].
- ★ If the free play is incorrect, adjust the throttle cable.

Throttle Lever Free Play

Standard: about 2 mm (0.08 in.)

- Check that the throttle lever moves smoothly from full open to close, and the throttle closes quickly and completely in all steering positions by the return spring.
- ★ If the throttle lever does not return properly, check the throttle cable routing, cable adjustments, and cable damage. Then lubricate the throttle cable.
- Run the engine at the idle speed, and turn the handlebar all the way to the right and left to ensure that the idle speed does not change.
- ★ If the idle speed increase, check the throttle cable adjustment and the cable routing.
- Remove the seat (see Hull/Engine Hood chapter).
- Check throttle cable adjustment.
- With the throttle lever released, the upper stop [A] on the throttle pivot arm [B] should rest against the stopper [C] on the throttle body, and there should be slight slack in the throttle cable.
- When the throttle lever is fully applied (pulled), the lower stop [D] on the pivot arm should be all the way up against the stopper on the throttle body.

- ★ If necessary, adjust the throttle cable.
- Loosen and turn the locknuts [A] at the bracket until the upper stop on the pivot arm hits against the stopper on the throttle body with slight cable slack.
- Tighten the locknuts securely.

Torque - Throttle Cable Locknuts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

NOTE

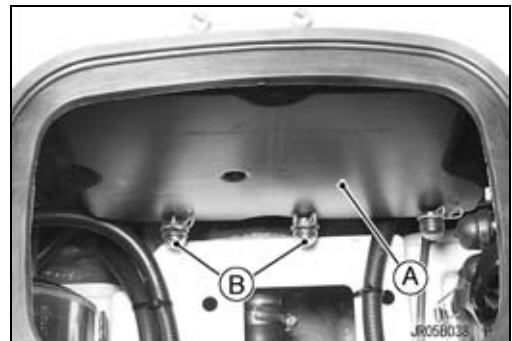
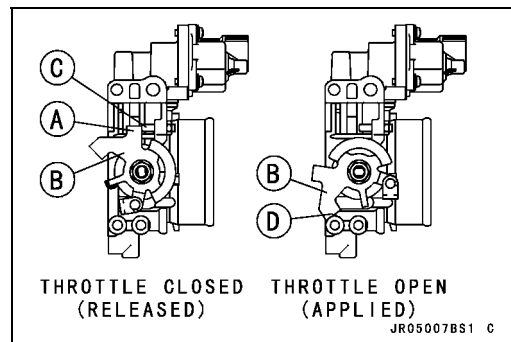
○ Make sure that the throttle pivot arm stops against the stopper on the throttle body with the throttle lever released.

Air Filter Drain Caps Inspection and Cleaning

- Remove the seat (see Hull/Engine Hood chapter).
- Remove the rear storage pocket.
- Inspect the air filter [A] for water inside with its drain caps [B].
- ★ If there is water in the caps, remove both caps and discharge the water.

NOTE

○ Be sure to have a rag or cloth underneath for possible oily water.



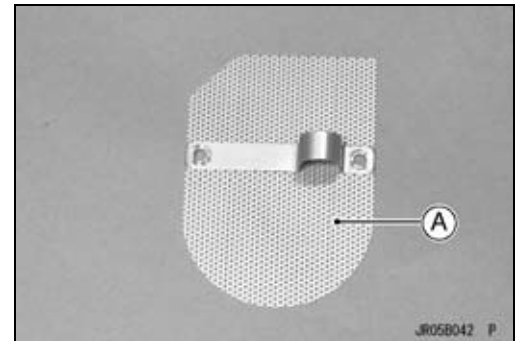
Periodic Maintenance Procedures

Air Filter Inspection and Cleaning

- Remove:
 - Air Filter (see Fuel System (DFI) chapter)
 - Flame Arrester [A] (see Air Filter Disassembly in Fuel System (DFI) chapter)



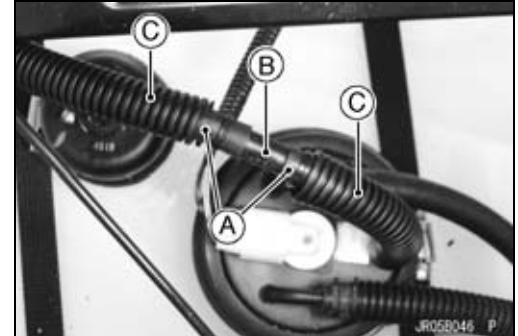
- Clean the flame arrester [A].
- Visually inspect the flame arrester for damage.
- ★ If necessary, replace it with a new one.



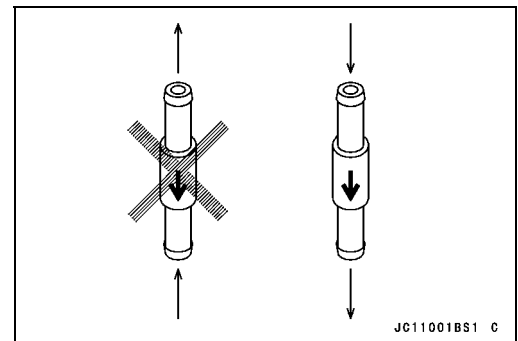
Fuel Vent Check Valve Inspection

The fuel vent check valve is mounted in the fuel tank vent hose to prevent fuel from spilling during riding. Air can flow into the tank to allow fuel to be drawn out by the fuel pump, but fuel cannot flow out the check valve.

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Cut off the bands [A].
- Pull out each end of the fuel vent check valve [B] from the vent hoses [C].



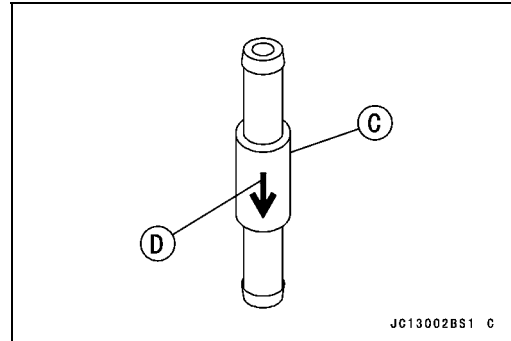
- Blow through the fuel vent check valve from each end.
- ★ If the check valve will allow air to flow as shown, it is OK.
- ★ If air will flow through the check valve in both direction or in neither direction, the check valve must be replaced.



2-12 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

- The fuel vent check valve [C] must be mounted so that the arrow [D] on its case is pointing toward the fuel tank.

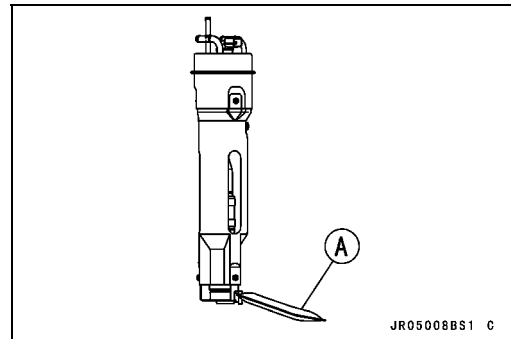


Fuel Pump Screen Cleaning

- Remove the fuel pump (see Fuel System chapter).
- Wash the fuel pump screen [A] in non-flammable or high-flash point solvent. Use a brush to remove any contaminants trapped in the screens.

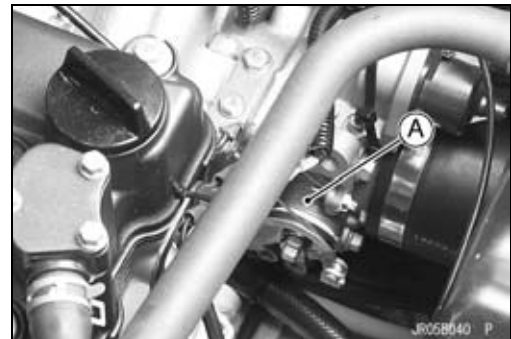
⚠ WARNING

Clean the fuel pump screen in a well-ventilated area, and take ample care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low flash-point solvent. A fire or explosion could result.



Throttle Shaft Spring Inspection

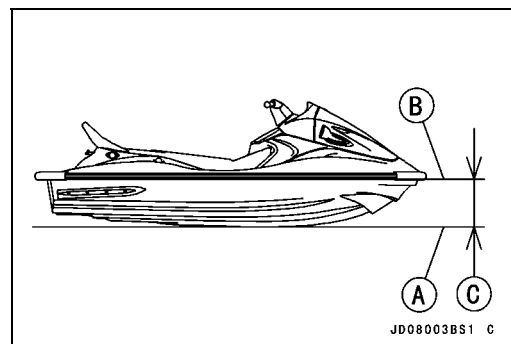
- Remove the seat (see Hull/Engine Hood chapter).
- Check the throttle shaft spring [A] by pulling the throttle lever.
- ★ If the springs are damaged or weak, replace the throttle body.



Engine Lubrication System

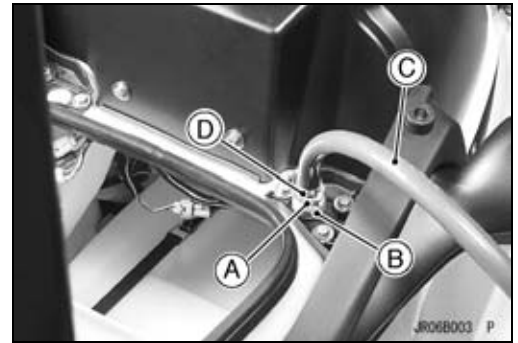
Engine Oil Change

- Level the watercraft port to starboard as well as fore to aft.
 - Level Ground [A]
 - Side Bumper [B]
 - Parallel [C]



Periodic Maintenance Procedures

- In a well-ventilated area, start the engine while cooling the cooling system.
- Open the front storage compartment cover.
- Remove the flushing cap (see Cooling System Flushing).
- Screw a garden hose adapter [A] onto the flushing fitting [B].
- Attach a garden hose [C] to a garden hose adapter and secure the hose clamp [D].
- Warm up the engine and stop it.



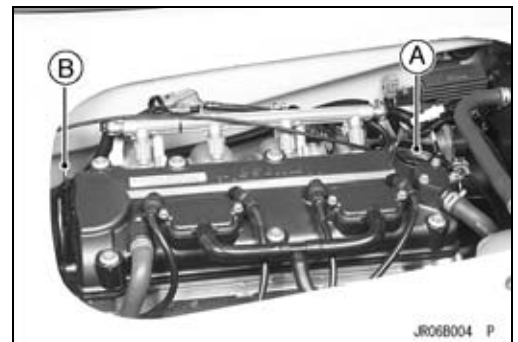
CAUTION

The engine must be running before the water is turned on and the water must be turned off before the engine is stopped. Do not run the engine without cooling water flow for more than 15 seconds.

- Remove the seat (see Hull/Engine Hood chapter).
- Remove the oil filler cap [A] and the dipstick [B].

CAUTION

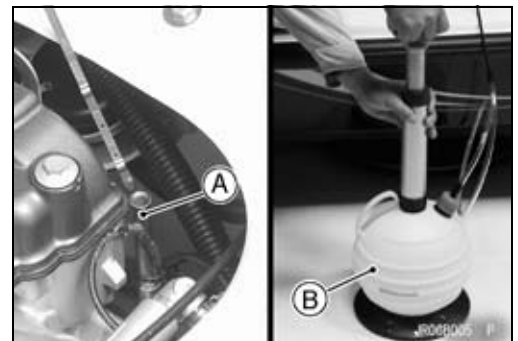
Be careful not to allow any dirt or foreign materials to enter the engine.



- Drain the oil through from the dipstick tube [A] using a commercially-available vacuum pump [B].

⚠ WARNING

Do not discard the engine oil as the engine oil is toxic substance and will pollute the environment. Contact your local authority for approved disposal methods.



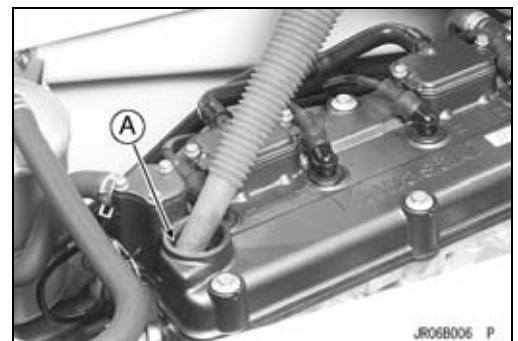
- Pour in the specified type and amount of oil through the oil filler opening [A].

Engine Oil

**Grade: API SE, SF or SG
API SH or SJ with JASO MA**

Viscosity: SAE 10W-40

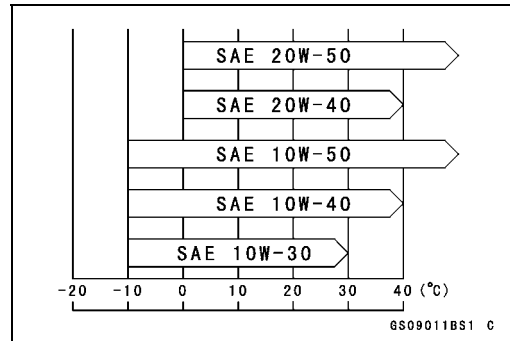
**Amount: 4.0 L (4.2 US qt, with or without the filter)
5.0 L (5.3 US qt, when engine is completely dry)**



2-14 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

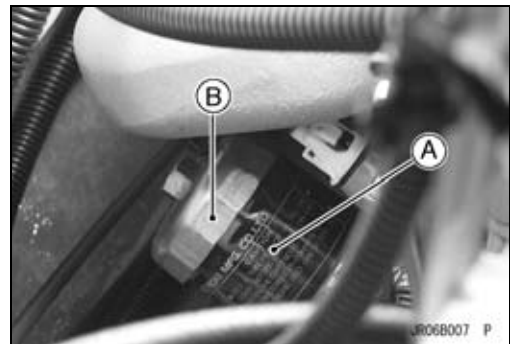
○ Depending on the atmospheric temperature of your riding area, the engine oil viscosity should be changed according to the chart shown.



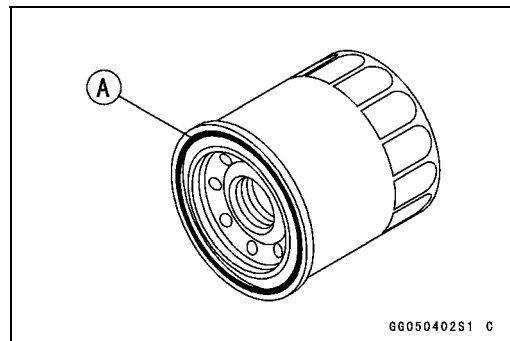
- Install the filler cap.
Torque - Oil Filler Cap: 1.0 N·m (0.10 kgf·m, 8.7 in·lb)
- Check the oil level (see Engine Lubrication System chapter).

Oil Filter Replace

- Remove:
Seat (see Hull/Engine Hood chapter)
- Drain the engine oil (see Engine Oil Change).
- Place a rag or cloth under the oil filter to receive the remaining oil.
- Remove the oil filter [A] with the oil filter wrench [B].
Special Tool - Oil Filter Wrench: 57001-1249



- Replace the filter with a new one.
- Apply engine oil to the gasket [A] before installation.
- Tighten the filter with the oil filter wrench.
- Torque - Oil Filter: 18 N·m (1.8 kgf·m, 13 ft·lb)**
- Pour in the specified type and amount of oil (see Engine Oil Change).

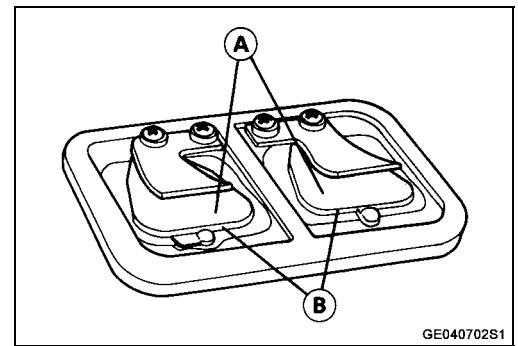


Periodic Maintenance Procedures

Engine Top End

Air Suction Valve Inspection

- Remove the air suction valve (see Engine Top End chapter).
- Visually inspect the reeds [A] for cracks, folds, warps, heat damage, or other damage.
- ★ If there is any doubt as to the condition of the reed, replace the air suction valve as an assembly.
- Check the reed contact areas [B] of the valve holder for grooves, scratches, any signs of separation from the holder, or heat damage.
- ★ If there is any doubt as to the condition of the reed contact areas, replace the air suction valve as an assembly.
- ★ If any carbon or other foreign particles have accumulated between the reed and the reed contact area, wash the valve assembly with a high-flash point solvent.



CAUTION

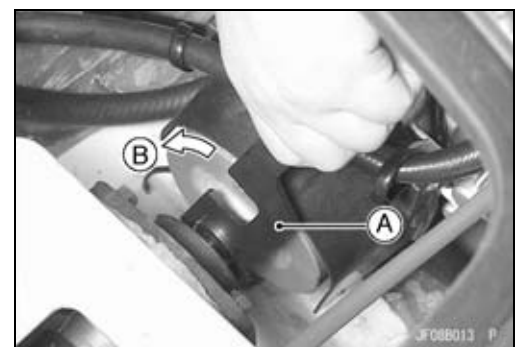
Do not scrape off the deposits with a scraper as this could damage the rubber, requiring replacement of the suction valve assembly.

Valve Clearance Inspection

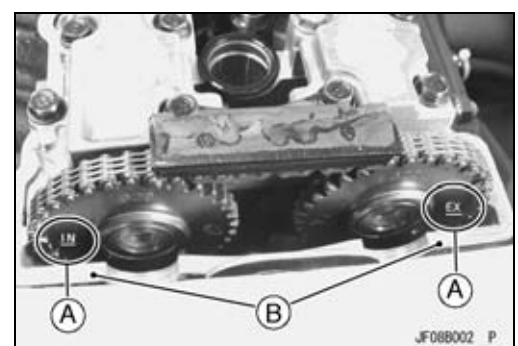
NOTE

○ Valve clearance must be checked and adjusted when the engine is cold (at room temperature).

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Cylinder Head Cover (see Engine Top End chapter)
 - Position the crankshaft at #1, #4 piston TDC as follows.
- Using the shaft wrench [A], turn the crankshaft counter-clockwise [B] and set the crankshaft at #1, 4 piston TDC.
- Special Tool - Shaft Wrench: 57001-1551**



○ The timing marks [A] must be aligned with the cylinder head upper surface [B] as shown.



2-16 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

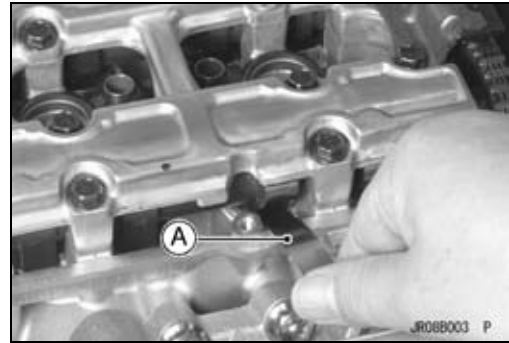
- Measure the valve clearance between the cam and the valve lifter with a thickness gauge [A].

Valve Clearance

Standard:

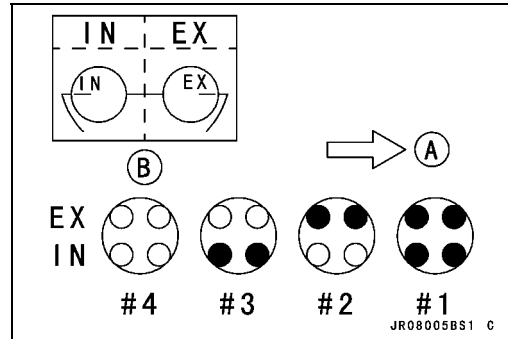
IN 0.15 ~ 0.24 mm (0.0059 ~ 0.0094 in.)

EX 0.22 ~ 0.31 mm (0.0087 ~ 0.0122 in.)



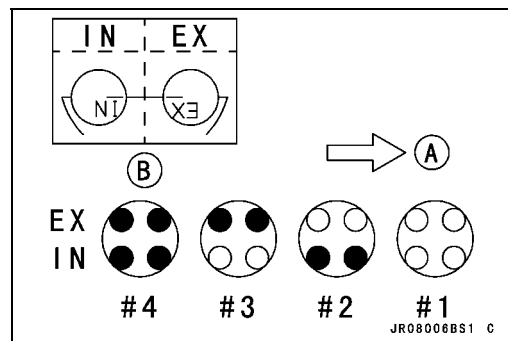
- When positioning #1 piston TDC at the end of the compression stroke:

Inlet Valve Clearance of #1 and #3 Cylinders
 Exhaust Valve Clearance of #1 and #2 Cylinders
 Measuring Valve [●]
 Bow [A]
 Camshaft Sprocket Position [B]



- When positioning #4 piston TDC at the end of the compression stroke:

Inlet Valve Clearance of #2 and #4 Cylinders
 Exhaust Valve Clearance of #3 and #4 Cylinders
 Measuring Valve [●]
 Bow [A]
 Camshaft Sprocket Position [B]

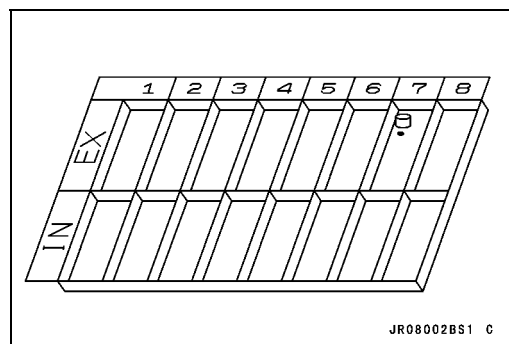


- ★ If the valve clearance is not within the specified range, first record the clearance, and then adjust it.

- To change the valve clearance, remove the camshaft chain tensioner, camshafts and valve lifters. Replace the shim with one of a different thickness.

NOTE

- Mark and record the valve lifter and shim locations so they can be reinstalled in their original positions.
- If there is no clearance, select a shim which is several sizes smaller and then measure the clearance.
- To select a new shim which brings the valve clearance within the specified range, refer to the Valve Clearance Adjustment Charts.



Periodic Maintenance Procedures

INLET VALVE CLEARANCE ADJUSTMENT CHART

		Present Shim																				
		← Example																				
Part No. (92025)		1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890
Mark		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	00
Thickness (mm)		2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00
Valve Clearance Measurement (mm)	0.00 ~ 0.02	—	—	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80
	0.03 ~ 0.06	—	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85
	0.07 ~ 0.11	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90
	0.12 ~ 0.14	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95
	0.15 ~ 0.24	Specified Clearance / No Change Required																				
	0.25 ~ 0.27	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	
	0.28 ~ 0.32	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00		
	0.33 ~ 0.37	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00			
	0.38 ~ 0.42	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00				
	0.43 ~ 0.47	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00					
	0.48 ~ 0.52	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00						
	0.53 ~ 0.57	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00							
	0.58 ~ 0.62	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00								
	0.63 ~ 0.67	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00									
	0.68 ~ 0.72	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00										
	0.73 ~ 0.77	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00											
	0.78 ~ 0.82	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00												
	0.83 ~ 0.87	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00													
	0.88 ~ 0.92	2.70	2.75	2.80	2.85	2.90	2.95	3.00														
	0.93 ~ 0.97	2.75	2.80	2.85	2.90	2.95	3.00															
0.98 ~ 1.02	2.80	2.85	2.90	2.95	3.00																	
1.03 ~ 1.07	2.85	2.90	2.95	3.00																		
1.08 ~ 1.12	2.90	2.95	3.00																			
1.13 ~ 1.17	2.95	3.00																				
1.18 ~ 1.22	3.00																					

Install the shim of this thickness (mm).

1. Measure the clearance (when engine is cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Install the shim specified where the lines intersect.
This shim will give the proper clearance.

Example

Present shim is **2.60 mm**.
 Measured clearance is **0.35 mm**.
 Replace **2.60 mm** shim with **2.75 mm** shim.

5. Remeasure the valve clearance and readjust if necessary.

2-18 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

EXHAUST VALVE CLEARANCE ADJUSTMENT CHART

		Present Shim																				
																					Example	
Part No. (92025)	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	
Mark	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	00	
Thickness (mm)	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	
Valve Clearance Measurement (mm)	0.00 ~ 0.04	—	—	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	
	0.05 ~ 0.09	—	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	
	0.10 ~ 0.14	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	
	0.15 ~ 0.19	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	
	0.20 ~ 0.21	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95
	0.22 ~ 0.31	Specified Clearance / No Change Required																				
	0.32 ~ 0.34	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	
	0.35 ~ 0.39	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00		
	0.40 ~ 0.44	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00			
	0.45 ~ 0.49	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00				
	0.50 ~ 0.54	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00					
	0.55 ~ 0.59	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00						
	0.60 ~ 0.64	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00							
	0.65 ~ 0.69	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00								
	0.70 ~ 0.74	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00									
	0.75 ~ 0.79	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00										
	0.80 ~ 0.84	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00											
	0.85 ~ 0.89	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00												
	0.90 ~ 0.94	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00													
	0.95 ~ 0.99	2.70	2.75	2.80	2.85	2.90	2.95	3.00														
1.00 ~ 1.04	2.75	2.80	2.85	2.90	2.95	3.00																
1.05 ~ 1.09	2.80	2.85	2.90	2.95	3.00																	
1.10 ~ 1.14	2.85	2.90	2.95	3.00																		
1.15 ~ 1.19	2.90	2.95	3.00																			
1.20 ~ 1.24	2.95	3.00																				
1.25 ~ 1.29	3.00																					

Install the shim of this thickness (mm).

1. Measure the clearance (when engine is cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Install the shim specified where the lines intersect. This shim will give the proper clearance.

Example

Present shim is **2.65 mm**.
 Measured clearance is **0.42 mm**.
 Replace **2.65 mm** shim with **2.80 mm** shim.

5. Remeasure the valve clearance and readjust if necessary.

Periodic Maintenance Procedures

- Apply molybdenum disulfide oil to the valve lifters and apply engine oil to the shims, and install them.
- Install the camshafts. Be sure to install the camshafts properly (see Engine Top End chapter).
- Remeasure any valve clearance that was adjusted.
- Readjust if necessary.

CAUTION

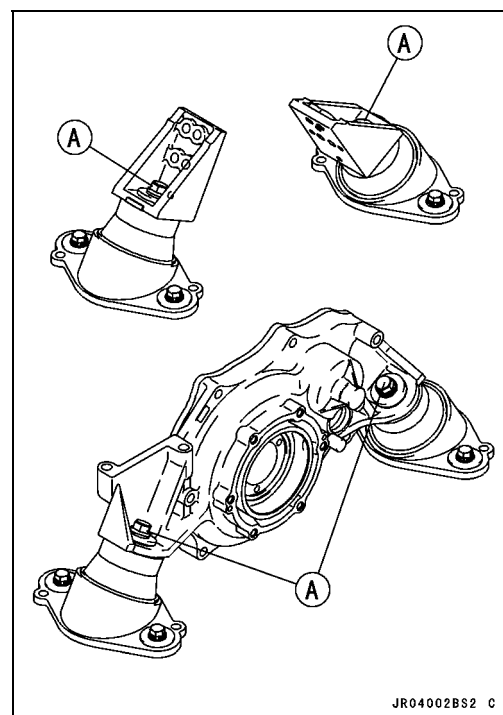
Do not put shim stock under the shim. This may cause the shim to pop out at high rpm, causing extensive engine damage.

Do not grind the shim. This may cause it to fracture, causing extensive engine damage.

Engine Mounting Bolts Inspection and Tightness

- Check the tightness of the engine mounting bolts [A].
- ★ If there are loose bolts, remove the bolts.
- Apply a non-permanent locking agent to the engine mounting bolts and tighten them.

Torque - Engine Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)

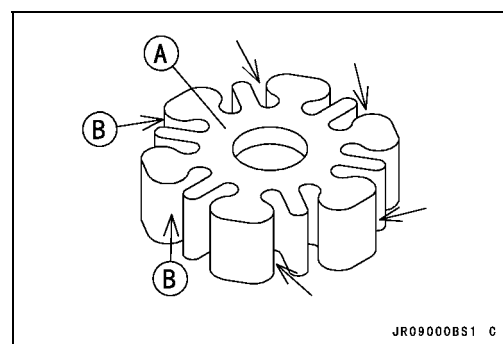


JR04002BS2 C

Engine Bottom End

Coupling Damper Inspection

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Engine (see Engine Removal/Installation chapter)
- Remove the coupling damper [A] and inspect it for wear [B] and deterioration.
- ★ If it is grooved or misshapen, replace it with a new damper.
- ★ If there is any doubt as to coupler condition, replace it.



JR09000BS1 C

Cooling and Bilge Systems

Cooling System Flushing

To prevent sand or salt deposits from accumulating in the cooling system, it must be flushed occasionally. Flush the system according to the Periodic Maintenance Chart, after each use in salt water, or whenever there is reduced water flow from the bypass outlet on the right side of the hull.

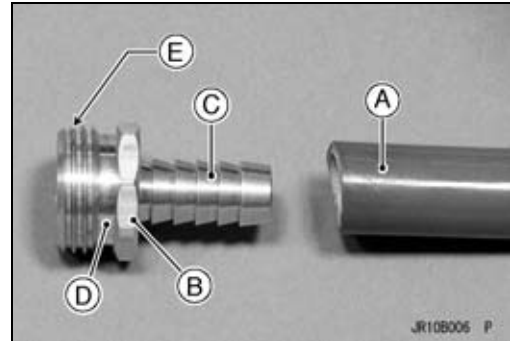
2-20 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

- Obtain a standard garden hose [A] and a garden hose adapter [B] as shown.
 - Garden Hose Fitting of Adapter [C]
 - Flushing Fitting of Adapter [D]
 - Thread: Rp 3/4 [E]

NOTE

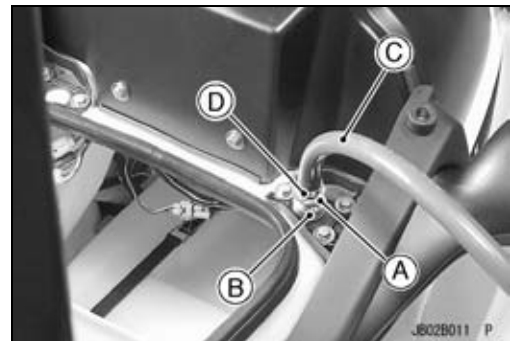
- *Optional part (P/No. 92005-3746) is available as a garden hose adapter.*



- Open the front storage compartment cover.
- Remove the flushing cap [A] on the brim of the storage compartment.



- Screw a garden hose adapter [A] onto the flushing fitting [B].
- Attach a garden hose [C] to a garden hose adapter and secure the hose clamp [D].

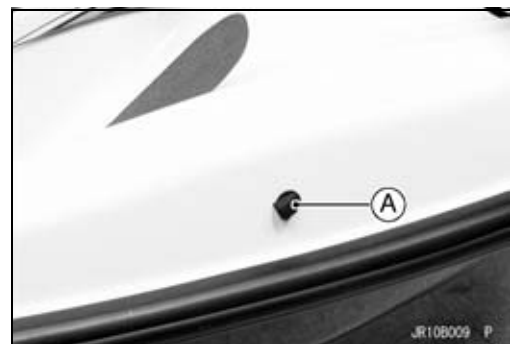


- Start the engine and allow it to idle before turning on the water.

CAUTION

The engine must be running before the water is turned on or water may flow back through the exhaust pipe into the engine, resulting in the possibility of severe internal damage.

- Immediately turn on the water and adjust the flow so that a little trickle of water comes out of the bypass outlet [A] on the right side of the hull.



Periodic Maintenance Procedures

- Leave the engine idle for several minutes with the water running.
- Turn off the water. Leave the engine idling.
- Rev the engine a few times to clear the water out of the exhaust system.

CAUTION

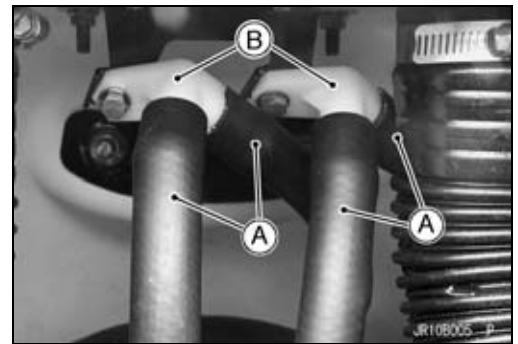
Do not run the engine without cooling water supply for more than 15 seconds, especially in high revolutionary speed or severe engine and exhaust system damage will occur.

- Switch off the engine, remove the garden hose and the adapter.
- Install the flushing cap securely.

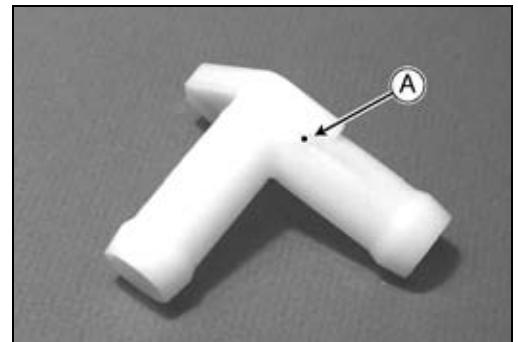
Bilge System Flushing

To prevent clogging, the bilge system should be flushed out according to the Periodic Maintenance Chart, or whenever you suspect it is blocked.

- Disconnect both bilge hoses [A] at the plastic breather fitting [B].



- Connect the bilge filter hoses (from the hull bottom) to the garden hoses, turn the water on, and flush it out for about a minute. During this procedure, water will flow into the engine compartment. Do not allow a large amount of water to accumulate in the engine compartment. Remove the drain screws in the stern to drain the engine compartment.
- Connect the other hoses (from the hull bulkhead) to the garden hose, turn the water on, and flush it out for several minutes.
- Before reconnecting the hoses to the plastic breather fitting make sure the small hole [A], on top of the breather fitting is clear.
- Reconnect the bilge hoses.



2-22 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

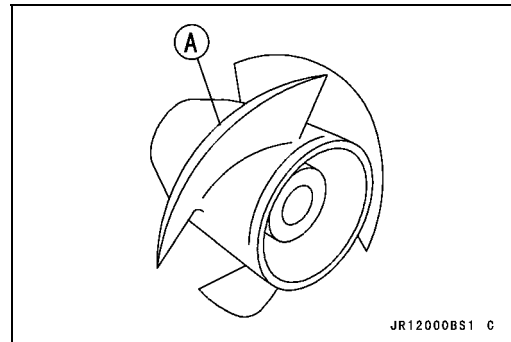
Pump and Impeller

Impeller Inspection

- Examine the impeller. [A]
- ★ If there is pitting, deep scratches, nicks or other damage, replace the impeller.

NOTE

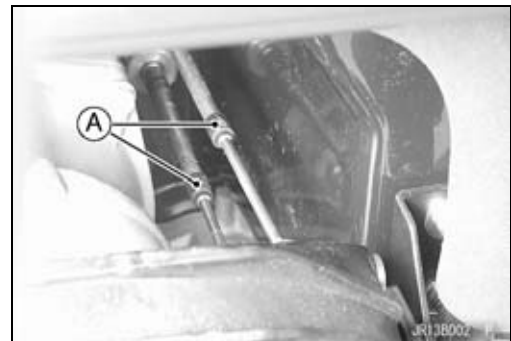
○ Minor nicks and gouges in the impeller blades can be removed with abrasive paper or careful filing. Smooth leading edges are especially important to avoid cavitation.



Steering

Steering Cable/Shift Cable Inspection

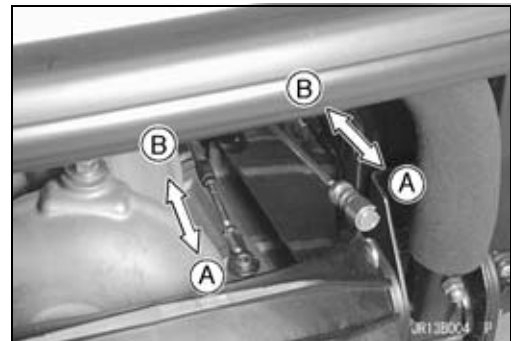
- Examine the steering cable or shift cable.
- ★ If each cables or cable housings are kinked or frayed, replace the cables.
- ★ If the each seal [A] at either end of each cable is damaged in any way, replace the cables.



- Be certain that each cable moves freely in both directions.
- Disconnect the cable joints at each end of each cable.
- Take out the cable joint bolt or ball joint and disconnect the cable joint.

CAUTION

Never lay the watercraft on the right side. Water in the exhaust system may drain back into the engine causing serious damage.



○ Slide the inner cable back [A] and forth [B] in each cable housings.

- ★ If each cable does not move freely, replace it.

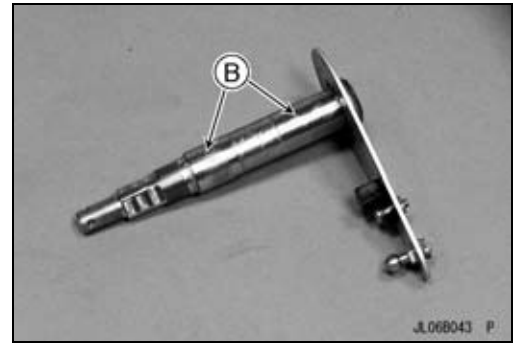
Handlebar Pivot Lubrication

- Check the bushings for damage and wear.
- ★ If the bushings are damaged or worn, replace them.
- Grease:
 - Bushings [A]



Periodic Maintenance Procedures

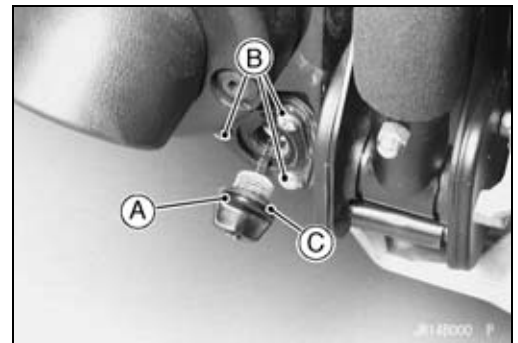
Steering Shaft [B]



Hull/Engine Hood

Drain Plug Inspection

- Check the drain plugs [A] for cracks or damage and the drain plug mounting screws [B] are tightened securely.
- Check the seals [C] for damage.
- ★ If necessary, replace the drain plugs or seals.



Electrical System

Battery Charging Condition Inspection

Battery charging condition can be checked by measuring battery terminal voltage.

- Disconnect the battery terminal leads (see Battery Removal in Electrical System chapter).

CAUTION

Be sure to disconnect the negative terminal lead first.

- Measure the battery terminal voltage.

NOTE

○ Measure with a digital voltmeter [A] which can be read one decimal place voltage.

- ★ If the reading is below the specified, refreshing charge is required (see Refreshing Charge in Electrical System chapter).

Battery Terminal Voltage

Standard: 12.6 V or more

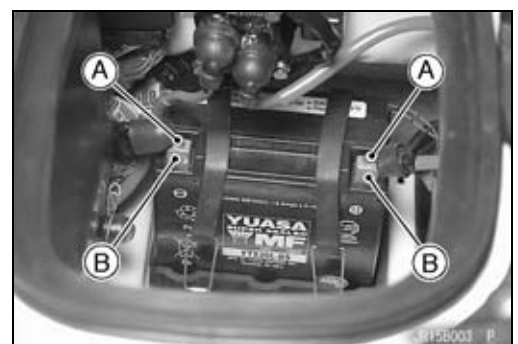
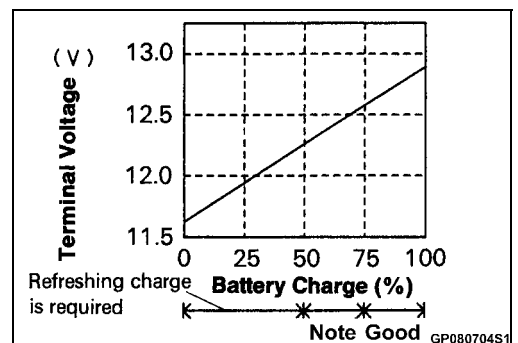
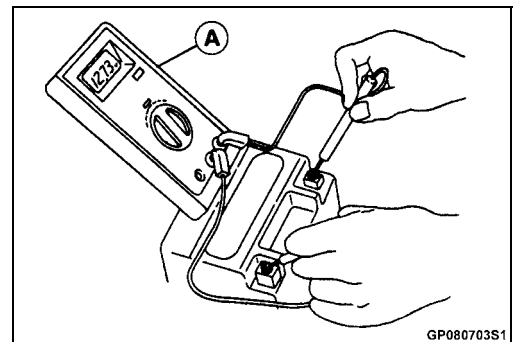
- Connect the battery leads, positive first.

Battery Terminals Inspection

- Check the battery terminal screws [A] for tightness and make sure terminal covers are in place.

⚠ WARNING

Loose battery cables can create sparks which can cause a fire or explosion resulting in injury or death. Make sure the battery terminal screws are tightened securely and the covers are installed over the terminals.



2-24 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

- Check that the battery terminals [B] are not corroded.
- ★ If necessary, remove the battery (see Electrical System chapter) and clean the terminals and cable ends using a solution of baking soda and water.
- After attaching both cables, coat the terminals and cable ends with grease to prevent corrosion.
- Install the battery (see Electrical System chapter).

Spark Plug Cleaning and Inspection

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Spark Plug Caps
- Remove the spark plugs using the 16 mm plug wrench [A].

Owner's Tool - Spark Plug Wrench, 16 mm: 92110-1145

- Clean the spark plug, preferably in a sandblasting device, and then clean off any abrasive particles. The plug may also be cleaned using a high-flash point solvent and a wire brush or other tool.
- ★ If the spark plug center electrode [A] and/or side electrode [B] are corroded or damaged, or if the insulator [C] is cracked, replace the plug. Use the standard spark plug or its equivalent.
- Measure the gaps [D] with a wire-type thickness gauge.
- ★ If the gap is incorrect, carefully bend the side electrode with a tool to obtain the correct gap.

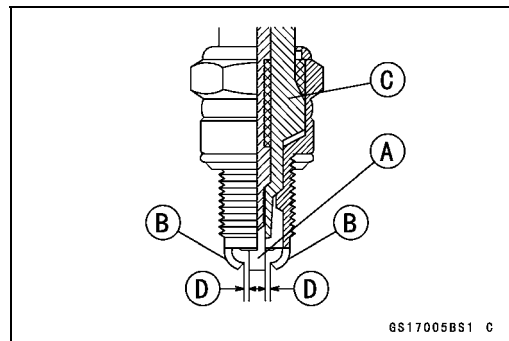
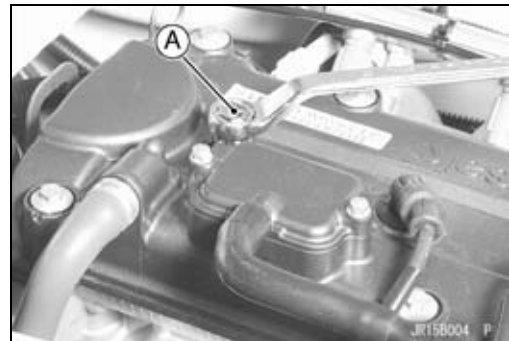
Spark Plug Gap: 0.7 ~ 0.8 mm (0.028 ~ 0.031 in.)

- Insert the spark plug vertically into the plug hole with the spark plug installed in the plug wrench [A].

Owner's Tool - Spark Plug Wrench, 16 mm: 92110-1145

- Tighten:

Torque - Spark Plugs: 13 N·m (1.3 kgf·m, 113 in·lb)



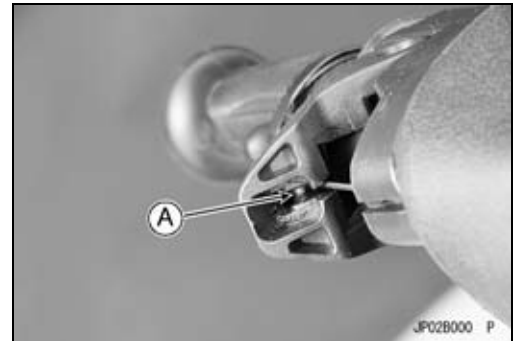
Lubrication

As in all marine craft, adequate lubrication and corrosion protection is an absolute necessity to provide long, reliable service. Refer to the Periodic Maintenance Chart for the frequency of the following items:

Periodic Maintenance Procedures

- Lubricate the following with grease.
- Pull the throttle lever and hold it.

Throttle Cable End [A] at Throttle Lever [A]

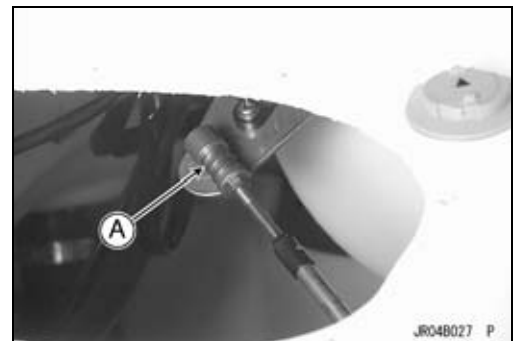


Throttle Cable End [A] at Throttle Body



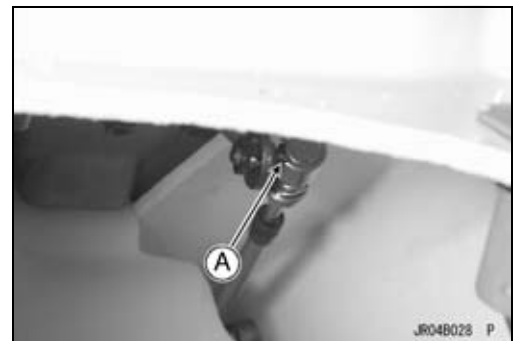
- Remove the storage pocket (see Hull/Engine Hood chapter).

Steering Cable Ball Joint [A] at Steering Shaft

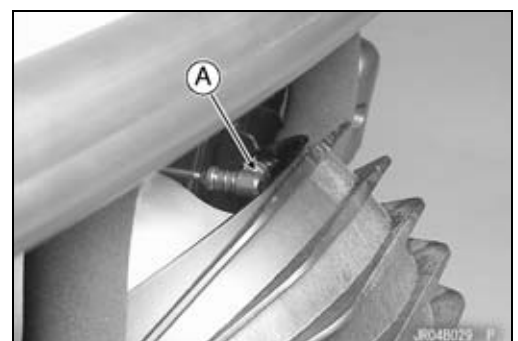


- Remove the storage pocket (see Hull/Engine Hood chapter).

Shift Cable Ball Joint [A] at Reverse Lever



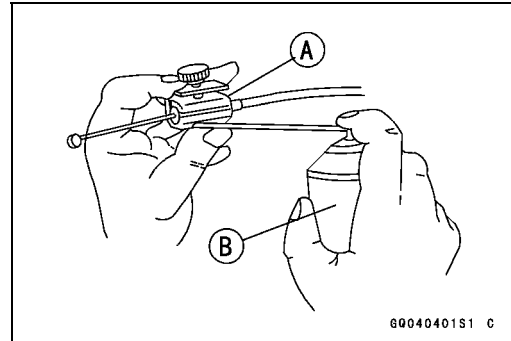
Shift Cable Ball Joint [A] at Reverse Bucket



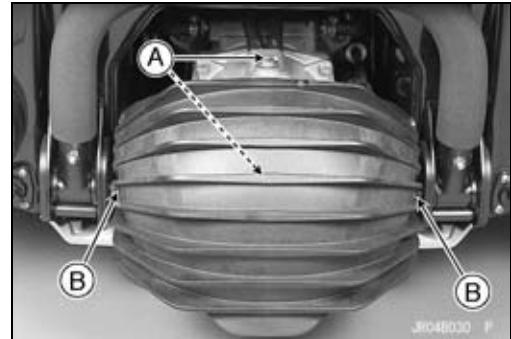
2-26 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

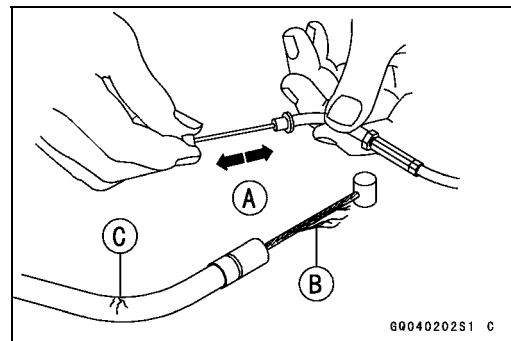
- Lubricate the following with a penetrating rust inhibitor [B].
Throttle Cable [A]



- Steering Nozzle Pivots [A]**
- Reverse Bucket Pivots [B]**



- With the cable disconnected at both ends, the cable should move freely [A] within the cable housing.
- ★ If cable movement is not free after lubricating, if the cable is frayed [B], or if the cable housing is kinked [C], replace the cable.



Periodic Maintenance Procedures

All Hoses, Hose Clamps, Nuts, Bolts and Fasteners Check

Nuts, Bolts, and Fasteners Tightness Inspection

- Check the tightness of the bolts and nuts listed here. Also, check to see that each cotter pin is in place and in good condition.

NOTE

○ For the engine fasteners, check the tightness of them when the engine is cold (at room temperature).

- ★ If there are loose fasteners, retighten them to the specified torque following the specified tightening sequence. Refer to the appropriate chapter for torque specifications. If torque specifications are not in the appropriate chapter, see the Standard Torque Table. For each fastener, first loosen it by 1/2 turn, then tighten it.
- ★ If cotter pins are damaged, replace them with new ones.

Nut, Bolt and Fastener to be checked

Engine:

- Oil Filter Cartridge
- Engine Mounting Bolts (and bracket bolts)
- Engine Damper Mounting Bolts
- Cylinder Head Cover Bolts
- Cylinder Head Bolts

Drive Shaft, Pump, and Impeller:

- Drive Shaft Holder Mounting Bolts
- Pump Mounting Bolts
- Pump Cover Mounting Bolts
- Pump Grate Mounting Bolts
- Steering Nozzle Pivot Bolts
- Reverse Bucket Pivot Bolts

Steering:

- Handlebar Clamp Bolts
- Steering Neck Mounting Bolts
- Steering Holder Mounting Bolts
- Steering Shaft Locknut
- Steering Cable Nut
- Steering Cable Joint Bolt
- Shift (reverse) Cable Nut

Hull and Engine Hood:

- Stabilizer Mounting Bolts
- Rear Grip Mounting Bolts

Electrical System:

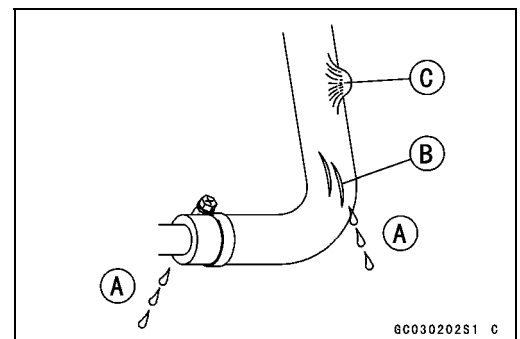
- Spark Plugs
- Battery Terminal

Hose and Hose Connect Inspection

- Check the following hoses for leakage [A], hardening, cracking [B], checking, cuts, abrasions, breaks and bulges [C]. And make sure the hoses are not kinked or pinched.

- Fuel Hoses
- Fuel Vent Hose
- Oil Hoses
- Cooling Hoses
- Bilge Hoses

- ★ If a hose is damaged in any way, replace it immediately and check all the others for damage.



2-28 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

- Make sure the above hoses are routed properly and secured with the clamps away from any moving parts and sharp edged portions.

Plastic Clamp [A]
Hose [B]
Hose Fitting [C]

NOTE

- The majority of bilge hoses have no clamps at the hose ends.

Metal Clamp [A]
Hose [B]
Hose Fitting [C]

NOTE

- Check the fuel and exhaust tubes for signs of wear, deterioration, damage or leakage. Replace if necessary.
- Make sure the above tubes are secured with the metal gear clamps away from any parts.

JT1500-A2 ~;

Double Spring Clamp [A]
Hose [B]
Hose Fitting [C]

NOTE

- Check the fuel hoses for signs of wear, deterioration, damage or leakage. Replace if necessary.
- Make sure the above hoses are secured with the double spring clamps away from any parts.

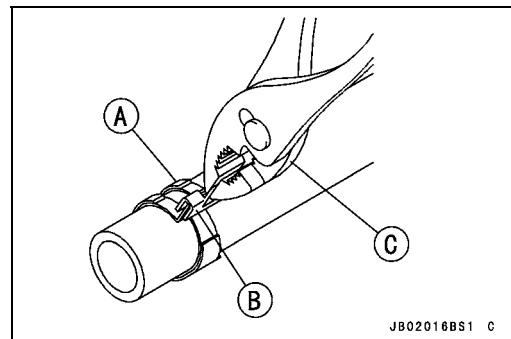
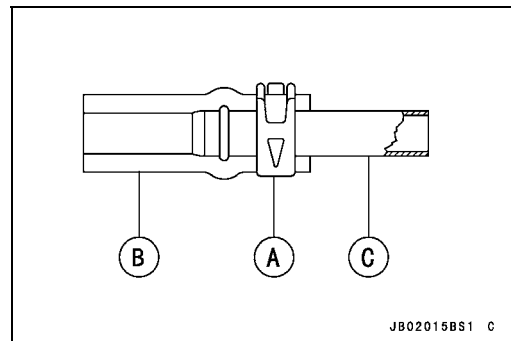
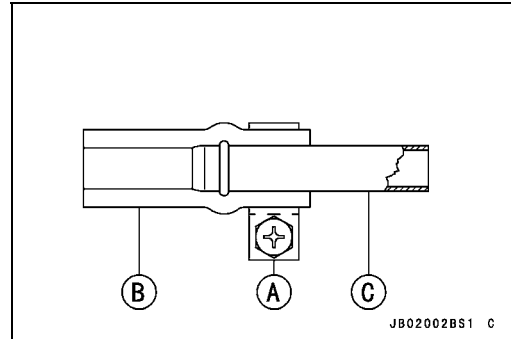
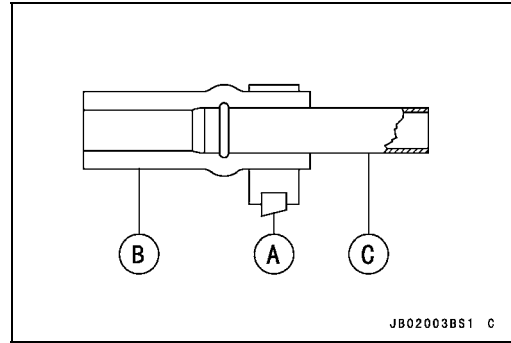
CAUTION

Do not reuse the double spring clamps on the fuel line.
Reusing will cause fuel leakage.
Replace the double spring clamps with new ones.

- Replacement procedure for the double spring clamp is as follows.
- Remove the double spring clamp with pliers and disconnect the fuel hose.
- Install the fuel hose and insert the new double spring clamp [A] with the clamp stopper [B].
- Pull up the clamp stopper with pliers [C].

NOTE

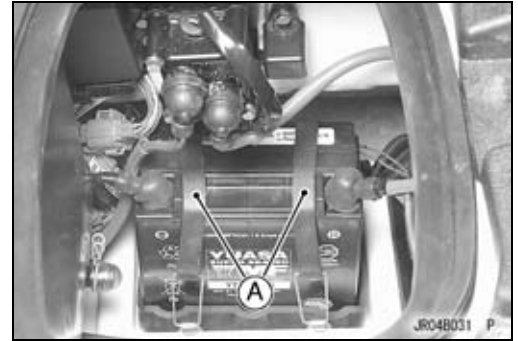
- Position the double spring clamp on the fuel hose correctly.



Periodic Maintenance Procedures

Rubber Strap Inspection

- Check the following rubber straps for any deterioration or damage. Pull on squeeze the straps and look for cracks.
 - Battery Straps [A]
 - Fuel Tank Straps
 - Water Box Muffler Straps
- ★ If a strap is damage in any way, replace it.



Fuel System (DFI)

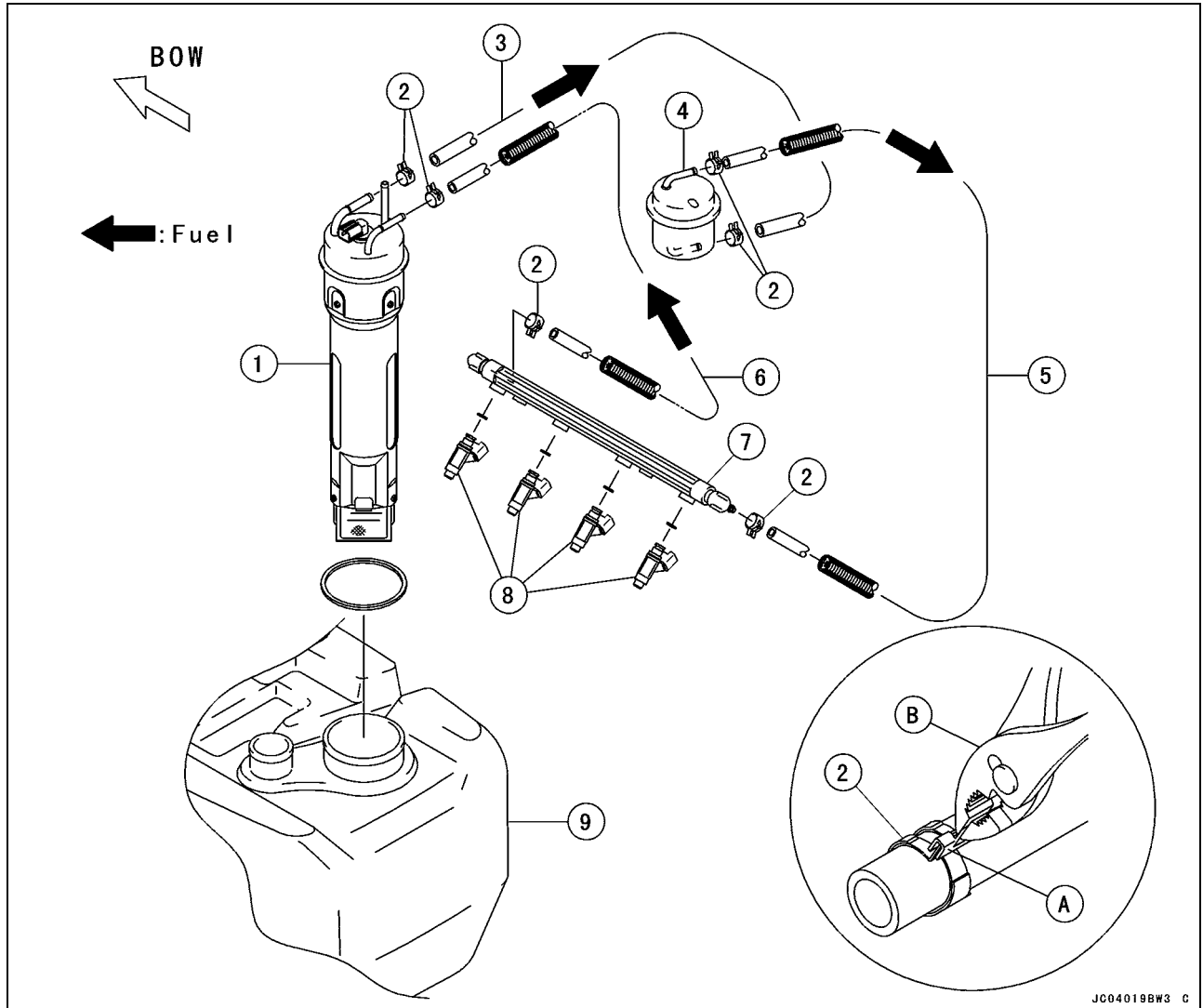
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3-2 FUEL SYSTEM (DFI)

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Fuel System Diagram

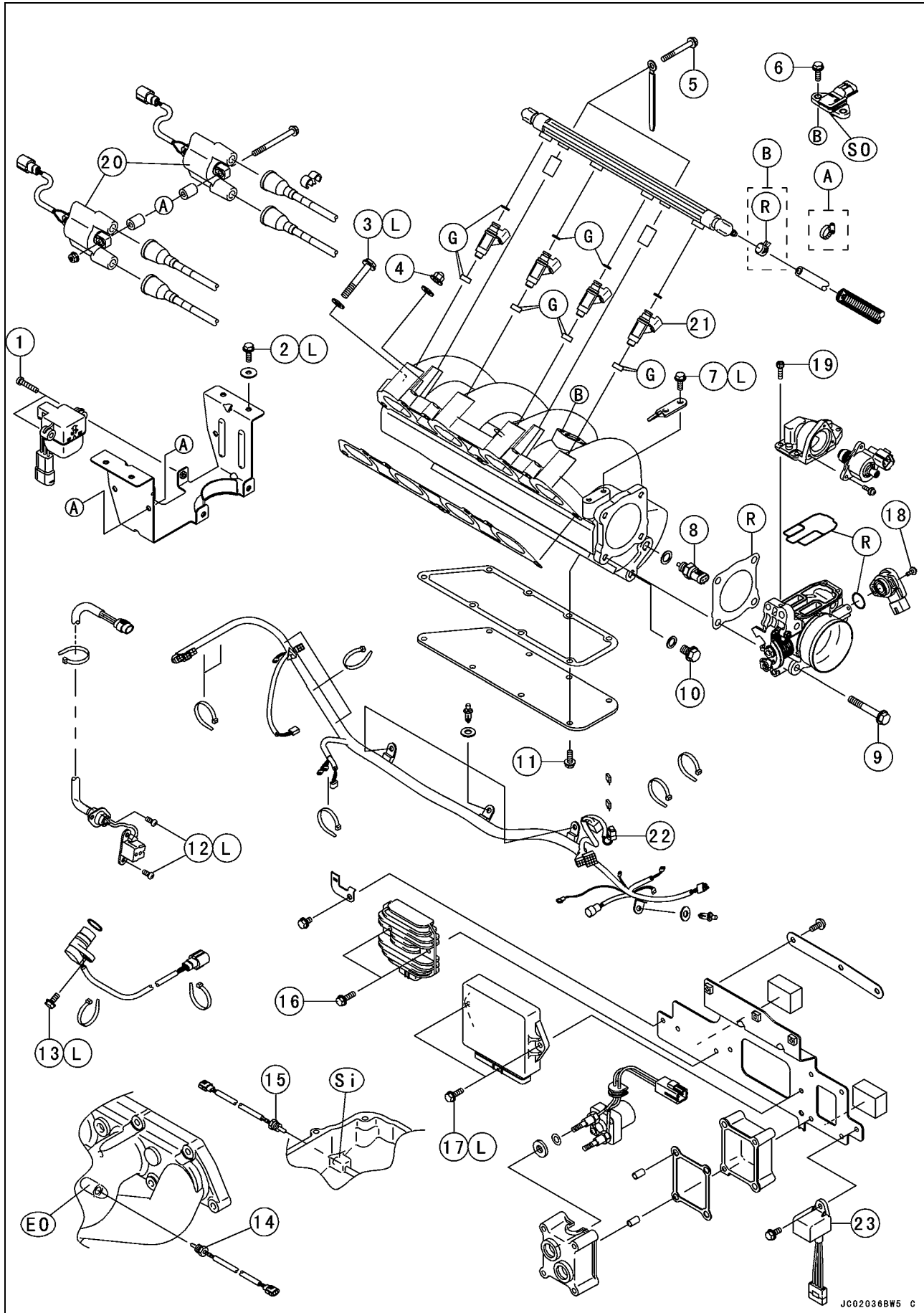


JC04019BW3 C

1. Fuel Pump
2. Clamps (JT1500-A1 Model)
Double Spring Clamps (JT1500-A2 Model ~)
(Installation Procedure: Pull up the clamp stopper [A] with pliers [B].)
3. Main Line
4. Fuel Filter
5. Supply Line
6. Return Line
7. Delivery Pipe
8. Fuel Injectors
9. Fuel Tank

3-4 FUEL SYSTEM (DFI)

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Vehicle-down Sensor Mounting Screws	1.5	0.15	13 in·lb	
2	Bracket Mounting Bolts	–	–	–	L
3	Inlet Manifold Mounting Bolts	25	2.5	18	L
4	Inlet Manifold Mounting Nuts	20	2.0	14	
5	Delivery Pipe Mounting Bolts	7.8	0.80	69 in·lb	
6	Inlet Air Pressure Sensor Bolts	7.8	0.80	69 in·lb	
7	Throttle Cable Holder Bolts	8.8	0.90	78 in·lb	L
8	Inlet Air Temperature Sensor	20	2.0	14	
9	Throttle Body Assy Mounting Bolts	20	2.0	14	
10	Inlet Manifold Drain Plug	20	2.0	14	
11	Inlet Manifold Plate Bolts	7.8	0.80	69 in·lb	
12	Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
13	Camshaft Position Sensor Bolt	7.8	0.80	69 in·lb	L
14	Water Temperature Sensor	15	1.5	11	see text
15	Oil Temperature Sensor	15	1.5	11	see text
16	Regulator/rectifier Bolts	7.8	0.80	69 in·lb	
17	ECU Mounting Bolts	8.8	0.90	78 in·lb	L
18	Throttle Sensor Mounting Screws	2.0	0.20	18 in·lb	
19	ISC Actuator Mounting Bolts	4.9	0.50	43 in·lb	

20. Ignition Coils

21. Fuel Injectors

22. Main Fuse 20 A

23. Relay Assembly (Main Relay/Fuel Pump Relay)

A: JT1500-A1 Model (Clamps)

B: JT1500-A2 Model ~-(Double Spring Clamps)

EO: Fill the hollow with the engine oil (10W-30).

G: Apply grease.

L: Apply a non-permanent locking agent.

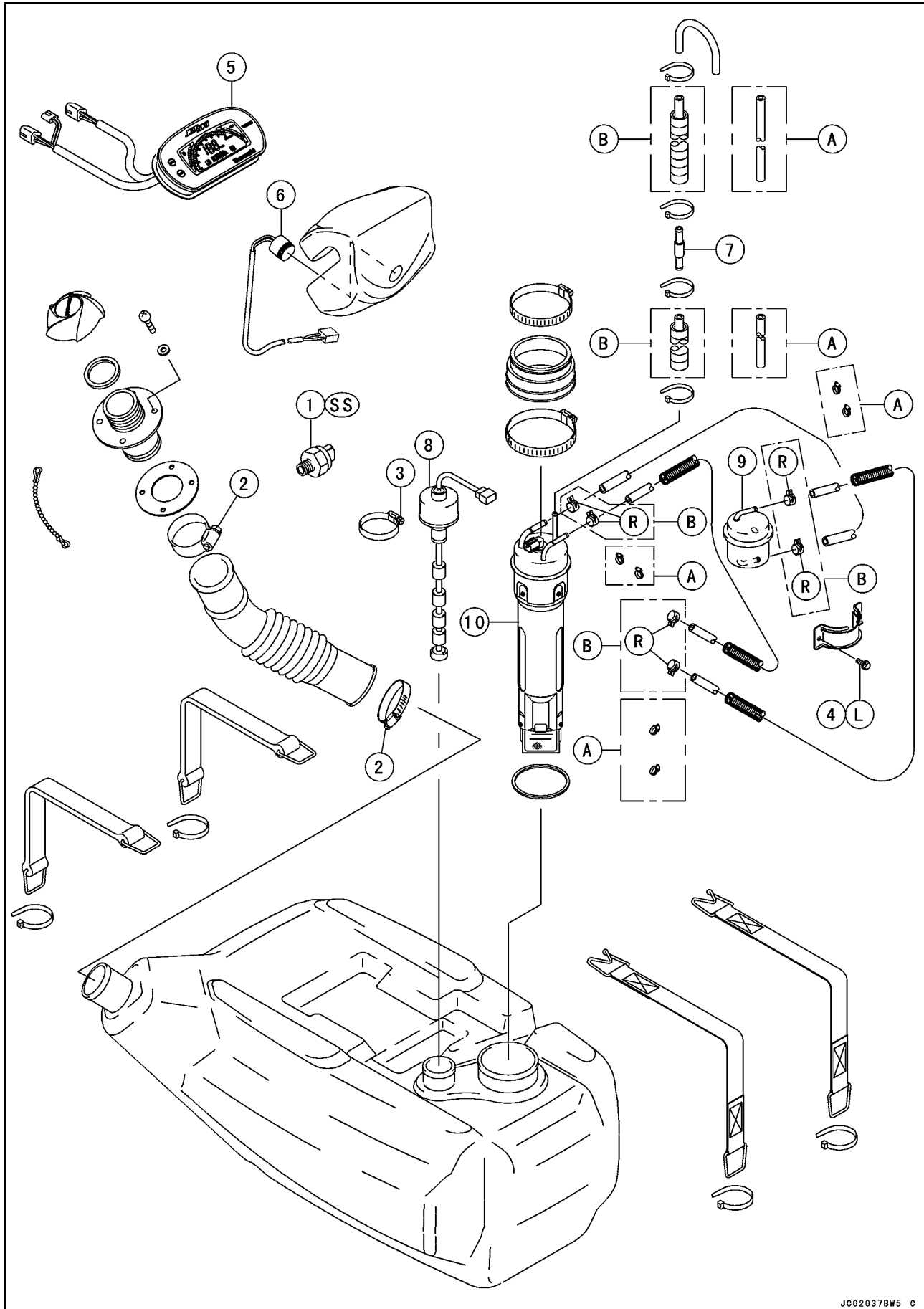
R: Replacement Parts

Si: Fill the hollow with the specified silicone grease (Kawasaki Bond: 92137-1002).

SO: Apply silicone oil to the O-ring.

3-6 FUEL SYSTEM (DFI)

Exploded View



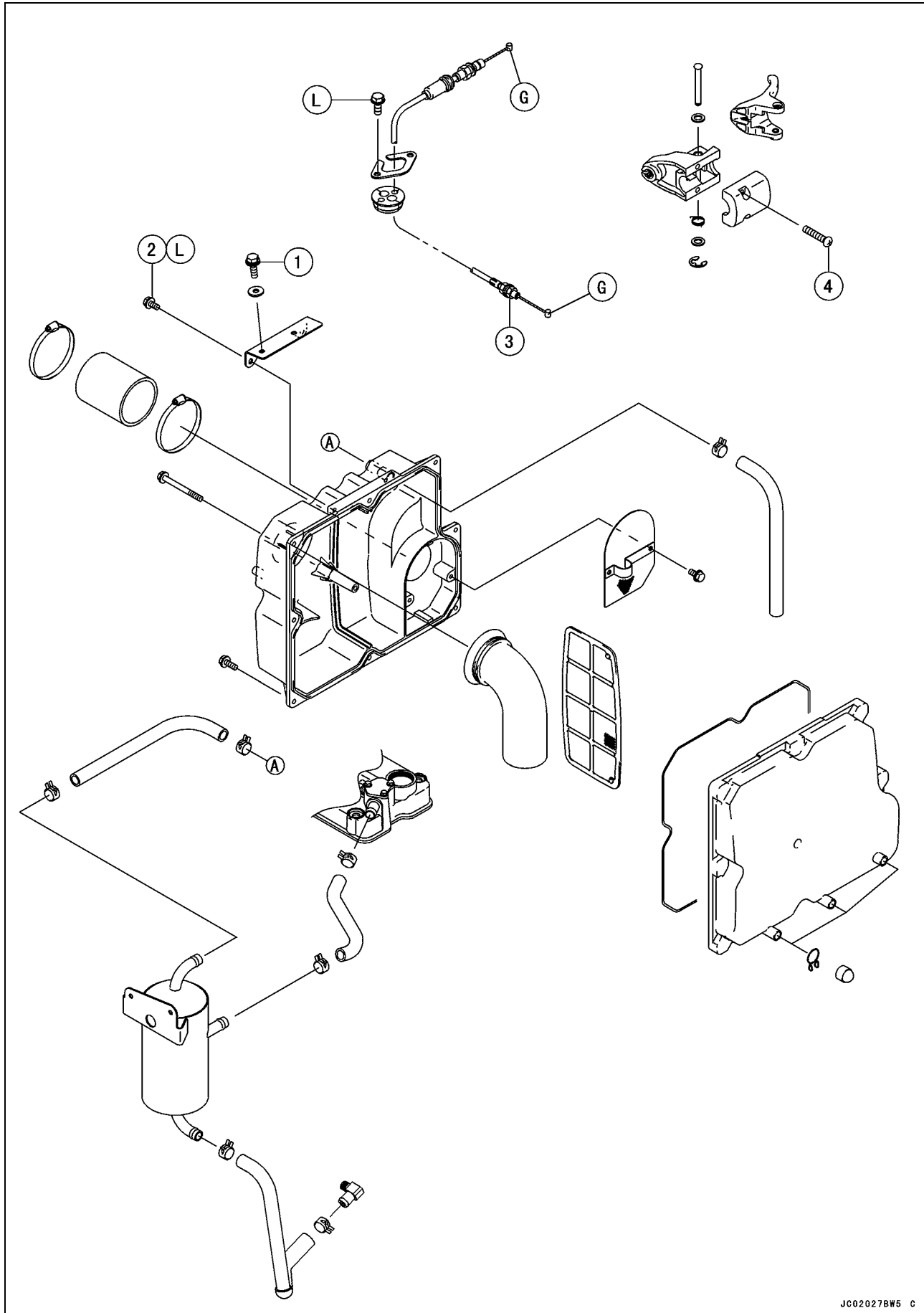
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil Pressure Switch	15	1.5	11	SS
2	Fuel Filler Tube Clamp Screws	2.9	0.30	26 in·lb	
3	Fuel Level Sensor Clamp Screw	2.9	0.30	26 in·lb	
4	Fuel Filter Mounting Bolts	8.8	0.90	78 in·lb	L

- 5. Meter Unit
- 6. Buzzer
- 7. Fuel Vent Check Valve
- 8. Fuel Level Sensor
- 9. Fuel Filter
- 10. Fuel Pump
- A: JT1500-A1 Model
- B: JT1500-A2 Model ~
- L: Apply a non-permanent locking agent.
- R: Replacement Parts
- SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

3-8 FUEL SYSTEM (DFI)

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Air Filter Mounting Bolts	9.8	1.0	87 in·lb	
2	Air Filter Bracket Mounting Bolts	7.8	0.80	69 in·lb	L
3	Throttle Cable Locknut	7.8	0.80	69 in·lb	
4	Throttle Case Mounting Screws	3.9	0.40	34 in·lb	

G: Apply grease.

L: Apply a non-permanent locking agent.

3-10 FUEL SYSTEM (DFI)

Specifications

Item	Standard
Digital Fuel Injection System	
Idle Speed	1 300 ±100 r/min (rpm) -both in and out of water
Throttle Assy:	
Type	Single type
Bore	φ60 mm (2.36 in.)
ECU (Electronic Control Unit):	
Make	Mitsubishi Electric
Type	Digital memory type, with built in IC igniter, sealed with resin
Operating range	Engine speed range 100 ~ 8 100 r/min (rpm)
Fuel Pressure (High Pressure Line):	
Engine Idling	approx. 294 kPa (3.0 kgf/cm ² , 43 psi)
Fuel Pump:	
Type	Impeller type
Discharge	67 mL or more for 3 seconds
Throttle Sensor:	
Input Voltage	4.75 ~ 5.25 V DC between R and BK/W leads
Output Voltage	1.08 ~ 1.18 V DC between G/W and BK/W leads (at idle throttle opening)
Resistance	4 ~ 6 kΩ
Inlet Air Pressure Sensor:	
Input Voltage	4.75 ~ 5.25 V DC between R and BK/W leads
Output Voltage	3.75 ~ 4.25 V DC between G/R and BK/W leads at standard atmospheric pressure
Inlet Air Temperature Sensor:	
Output Voltage at ECU	about 2.3 ~ 2.6 V @20°C (68°F)
Resistance	5.4 ~ 6.6 kΩ at 0°C (32°F) 2.26 ~ 2.86 kΩ at 20°C (68°F) 0.29 ~ 0.39 kΩ at 80°C (176°F)
Water Temperature Sensor:	
Resistance	see Electrical System chapter
Output Voltage at ECU	about 3 ~ 4 V @20°C (68°F)
Vehicle-down Sensor:	
Detection Method	Magnetic flux detection method
Detection Angle	more than 110 ~ 130° for each bank
Output Voltage	with sensor tilted 110 ~ 130° or more: 0.65~ 1.35 V with sensor arrow mark pointed up: 3.55 ~ 4.45 V
Fuel Injectors:	
Type	INP-281
Nozzle Type	One spray type with 4 holes
Resistance	about 11.7 ~ 12.3 Ω at 20°C (68°F)
Oil Temperature Sensor:	
Resistance	same to water temperature sensor
Output Voltage at ECU	about 3 ~ 4 V @20°C (68°F)

Specifications

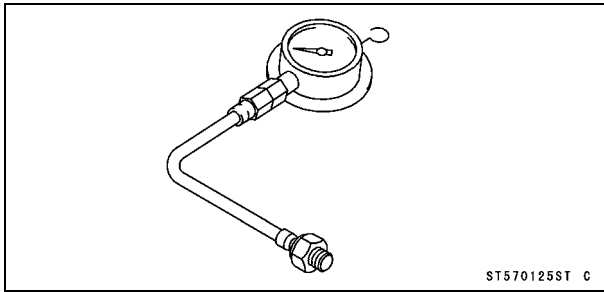
Item	Standard
Throttle Lever and Cables Throttle Lever Free Play	about 2 mm (0.08 in.)

3-12 FUEL SYSTEM (DFI)

Special Tools and Sealant

Oil Pressure Gauge, 5 kgf/cm²:

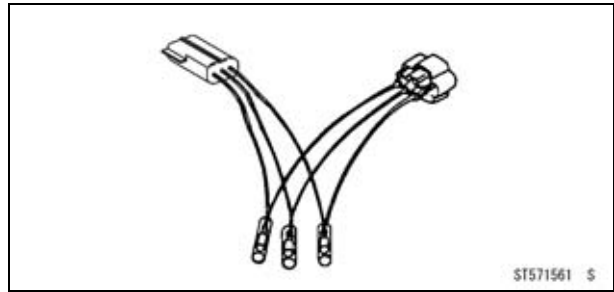
57001-125



ST570125ST C

Sensor Harness Adapter:

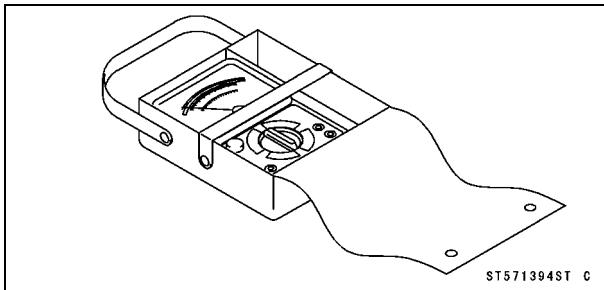
57001-1561



ST571561 S

Hand Tester:

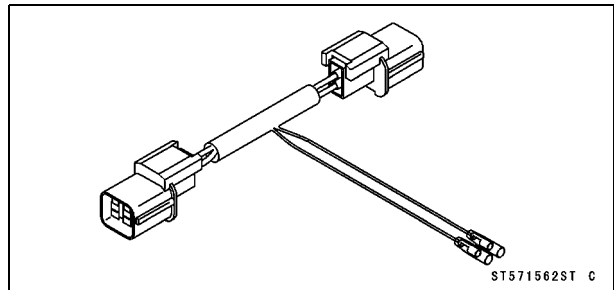
57001-1394



ST571394ST C

Harness Adapter:

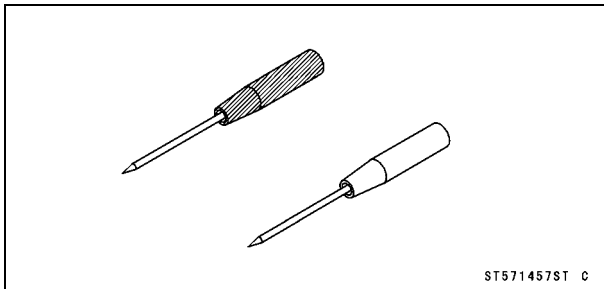
57001-1562



ST571562ST C

Needle Adapter Set:

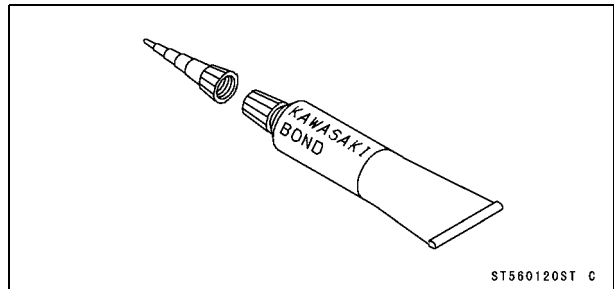
57001-1457



ST571457ST C

Kawasaki Bond (Silicone Sealant):

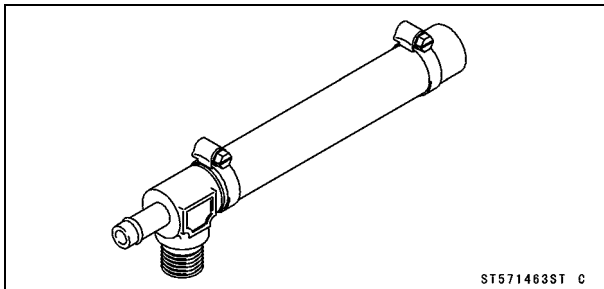
56019-120



ST560120ST C

Fuel Pressure Gauge Adapter:

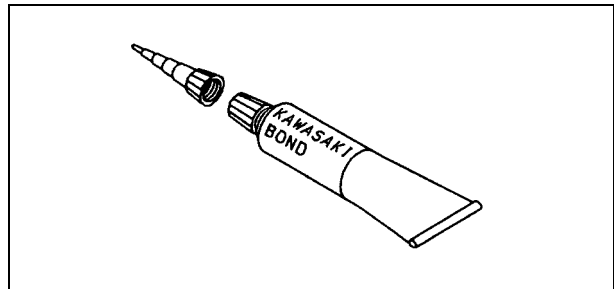
57001-1463



ST571463ST C

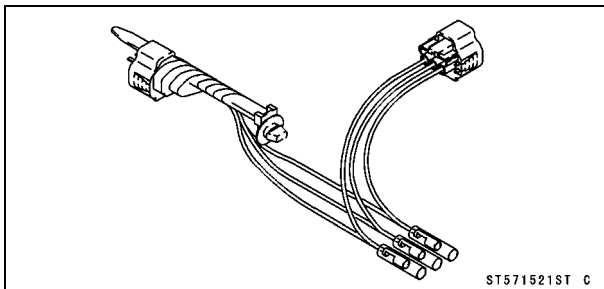
Kawasaki Bond (Silicone Grease):

92137-1002



Throttle Sensor Setting Adapter:

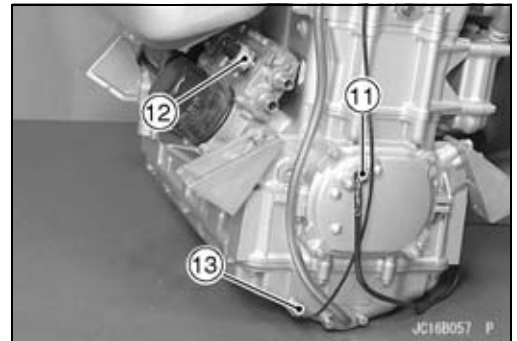
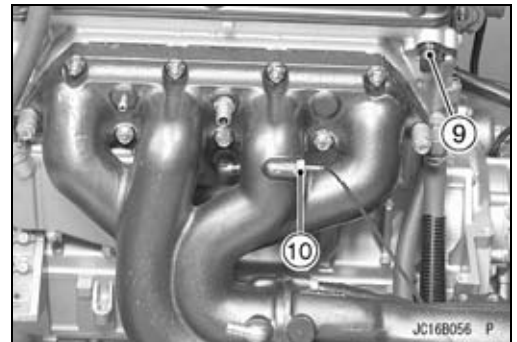
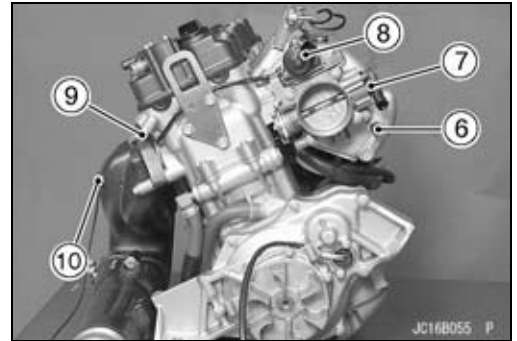
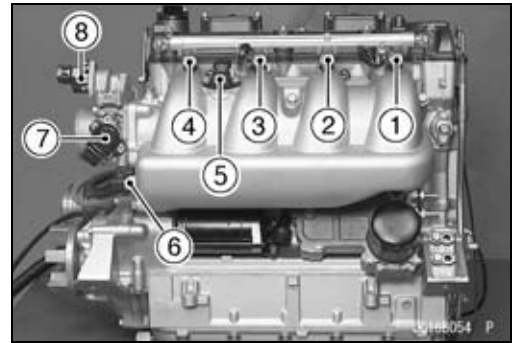
57001-1521



ST571521ST C

DFI Parts Location

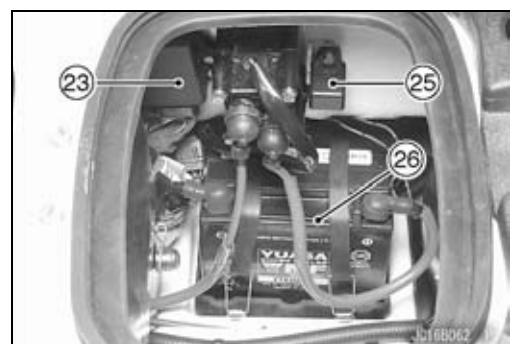
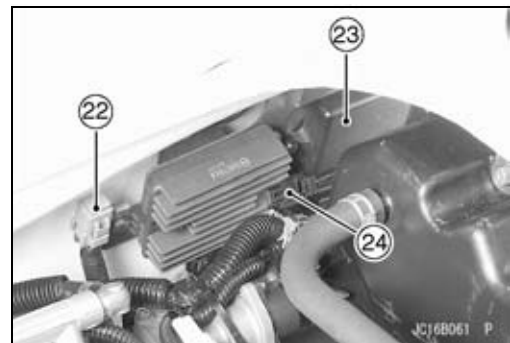
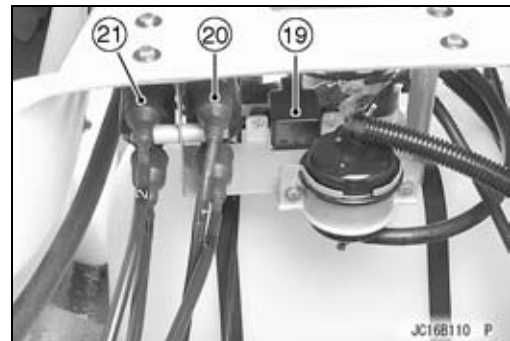
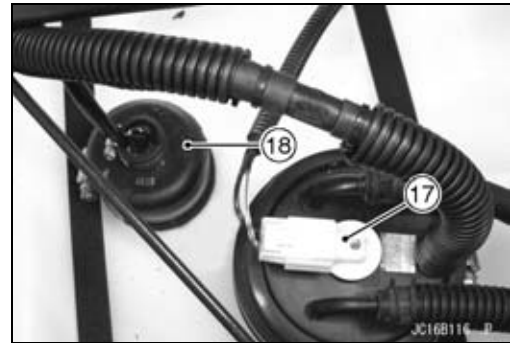
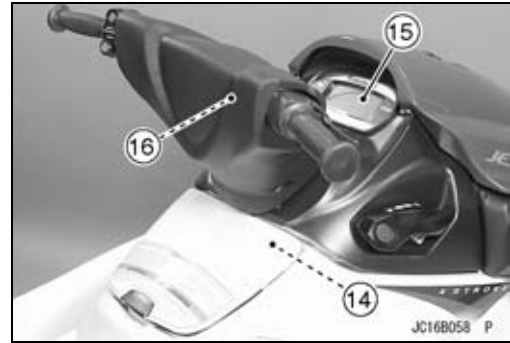
1. Fuel Injector #1
2. Fuel Injector #2
3. Fuel Injector #3
4. Fuel Injector #4
5. Inlet Air Pressure Sensor
6. Inlet Air Temperature Sensor
7. Throttle Sensor
8. ISC (Idle Speed Controller)
9. Camshaft Position Sensor
10. Water Temperature Sensor
11. Crankshaft Sensor
12. Oil Pressure Switch
13. Oil Temperature Sensor



3-14 FUEL SYSTEM (DFI)

DFI Parts Location

- 14. Ignition Switch
- 15. Meter Unit
- 16. Buzzer
- 17. Fuel Pump
- 18. Fuel Level Sensor
- 19. Vehicle-down Sensor
- 20. Ignition Coil #1, #4
- 21. Ignition Coil #2, #3
- 22. Main Fuse 20 A
- 23. ECU (Electronic Control Unit)
- 24. Diagnosis Connector
- 25. Relay Assembly (Main Relay/Fuel Pump Relay)
- 26. Battery



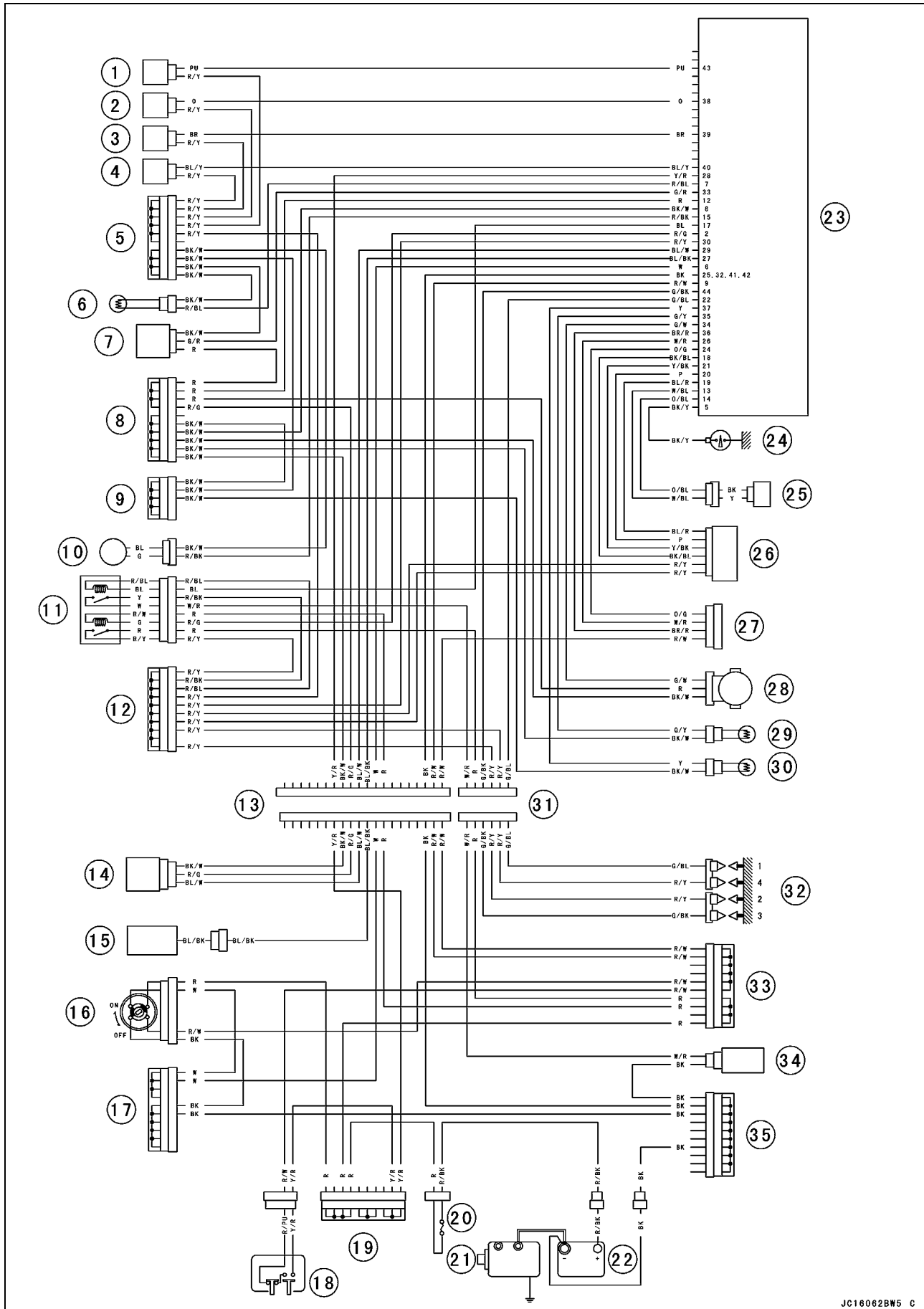
DFI Parts Location

Dummy Page

3-16 FUEL SYSTEM (DFI)

DFI System

DFI System Wiring Diagram



DFI System

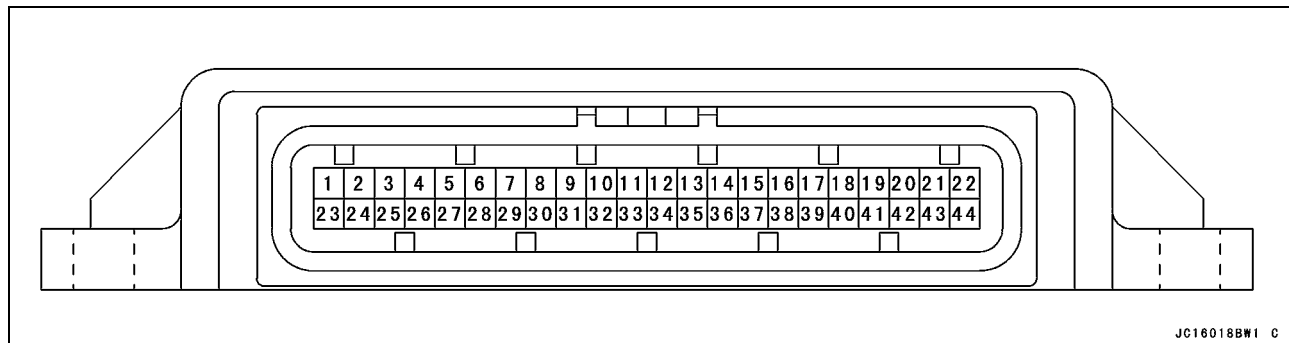
Part Name

1. Fuel Injector #1
2. Fuel Injector #2
3. Fuel Injector #3
4. Fuel Injector #4
5. Joint Connector H
6. Inlet Air Temperature Sensor
7. Inlet Air Pressure Sensor
8. Joint Connector E
9. Joint Connector J
10. Crankshaft Sensor
11. Relay Assembly (Main Relay/Fuel Pump Relay)
12. Joint Connector F
13. Connector C
14. Vehicle-down Sensor
15. Meter Unit (Diagnosis Signal)
16. Ignition Switch
17. Joint Connector Q
18. Start Switch
19. Joint Connector R
20. Main Fuse 20 A
21. Starter Motor
22. Battery
23. ECU (Electronic Control Unit)
24. Oil Pressure Switch
25. Camshaft Position Sensor
26. ISC (Idle Speed Controller)
27. Diagnosis Connector
28. Throttle Sensor
29. Water Temperature Sensor
30. Oil Temperature Sensor
31. Connector D
32. Ignition Coils
33. Joint Connector P
34. Fuel Pump
35. Joint Connector S

3-18 FUEL SYSTEM (DFI)

DFI System

Terminal Numbers of ECU Connectors



Terminal Names

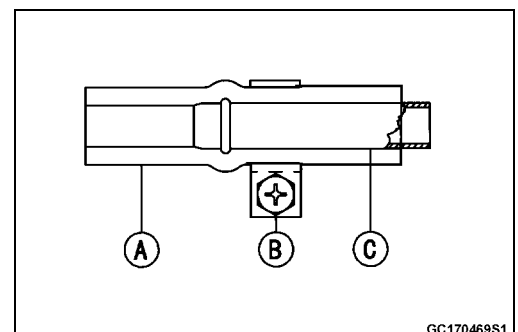
- | | |
|--|--|
| 1. Tachometer Signal | 24. Ground for External Diagnosis System |
| 2. ECU Main Relay | 25. Ground for Control System |
| 3. Unused | 26. External Diagnosis System Signal |
| 4. SLO (Smart Learning Operation) Mode (JT1500-A2 Model ~) | 27. Diagnosis Signal |
| 5. Oil Pressure Switch | 28. Start Button |
| 6. Engine Stop Switch | 29. Vehicle-down Sensor |
| 7. Inlet Air Temperature Sensor | 30. Power Supply to ECU (from Battery) |
| 8. Ground for Sensors | 31. Unused |
| 9. Ignition Switch | 32. Ground for Control System |
| 10. Steering Position Sensor | 33. Inlet Air Pressure Sensor |
| 11. Unused | 34. Throttle Sensor |
| 12. Power Supply to Sensors | 35. Water Temperature Sensor |
| 13. Cam Sensor (+) Signal | 36. External Diagnosis System Signal |
| 14. Cam Sensor (-) Signal | 37. Oil Temperature Sensor |
| 15. Crankshaft Sensor | 38. Injector #2 |
| 16. Unused | 39. Injector #3 |
| 17. Fuel Pump Relay | 40. Injector #4 |
| 18. ISC (Idle Speed Controller) | 41. Ground for Power System |
| 19. ISC (Idle Speed Controller) | 42. Ground for Power System |
| 20. ISC (Idle Speed Controller) | 43. Injector #1 |
| 21. ISC (Idle Speed Controller) | 44. Ignition Coil #2,#3 |
| 22. Ignition Coil #1,#4 | |
| 23. Unused | |

DFI Servicing Precautions

There are a number of important precautions that should be followed servicing the DFI system.

- This DFI system is designed to be used with a 12 V sealed battery as its power source. Do not use any other battery except for a 12 V sealed battery as a power source.
- Do not reverse the battery cable connections. This will damage the ECU.
- To prevent damage to the DFI parts, do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running.
- Take care not to short the leads that are directly connected to the battery positive (+) terminal to the engine ground.
- When charging, remove the battery from the vehicle. This is to prevent ECU damage by excessive voltage.
- Whenever the DFI electrical connections are to be disconnected, first turn off the ignition switch. Conversely, make sure that all the DFI electrical connections are firmly reconnected before starting the engine.
- Do not turn the ignition switch ON while any of the DFI electrical connectors are disconnected. The ECU memorizes service codes.
- If a transceiver is installed on the vehicle, make sure that the operation of the DFI system is not influenced by electric wave radiated from the antenna. Check operation of the system with the engine at idle. Locate the antenna as far as possible away from the ECU.
- When any fuel hose is disconnected, do not turn on the ignition switch. Otherwise, the fuel pump will operate and fuel will spout from the fuel hose.
- Do not operate the fuel pump if the pump is completely dry. This is to prevent pump seizure.
- Before removing the fuel system parts, blow the outer surfaces of these parts clean with compressed air.
- When any fuel hose is disconnected, fuel may spout out by residual pressure in the fuel line. Cover the hose joint with a piece of clean cloth to prevent fuel spillage.
- When installing the fuel hoses, avoid sharp bending, kinking, flattening or twisting, and route the fuel hoses with a minimum of bending so that the fuel flow will not be obstructed.
- Route the hoses according to Cable, Wire, and Hose Routing section in the Appendix chapter.
- Install the hose clamps in the position shown, and securely tighten the clamp bolts. Check the fuel system for leaks after hose installation.

Fuel Hose [A]
 Clamp [B]
 Fuel Pipe [C]



3-20 FUEL SYSTEM (DFI)

DFI Servicing Precautions

For JT1500-A2 ~;

○Install the double spring clamp in the position as shown, and securely pull up the clamp stopper with pliers. Check the fuel system for leaks after hose installation.

Fuel Hose [B]

Double Spring Clamp [A]

Fuel Pipe [C]

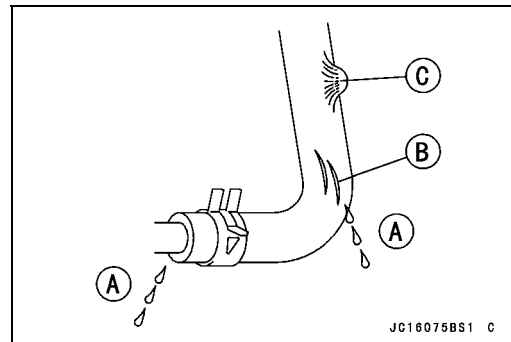
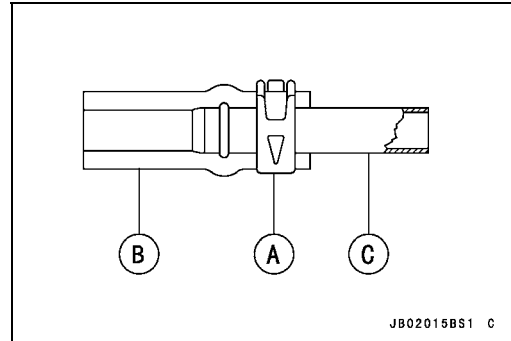
CAUTION

**Do not reuse the double spring clamps on the fuel line. Reusing will cause fuel leakage.
Replace the double spring clamps with new ones.**

○Replace the fuel hose if it has been sharply bent or kinked.

○The high pressure inside the fuel line can cause fuel to leak [A] or the hose to burst. Bend and twist the fuel hose while examining it.

○Replace the hose if any cracks [B] or bulges [C] are noticed.



○When checking the DFI parts, do not run the engine for 15 seconds or more without auxiliary cooling (see General Information chapter).

CAUTION

If running the engine without the auxiliary cooling for 15 seconds or more (even at idle speed), the rubber component relative to the Exhaust System may be damaged.

○Execute the auxiliary cooling securely in case that frequent engine running is required.

● When checking the DFI parts, use a digital meter which can be read two decimal place voltage or resistance.

○The DFI part connectors have seals, including the ECU. When measuring the input or output voltage with the connector joined, use the needle adapter set. Insert the needle adapter inside the seal until the needle adapter reaches the terminal.

Digital Meter [A]

Special Tool - Needle Adapter Set: 57001-1457

CAUTION

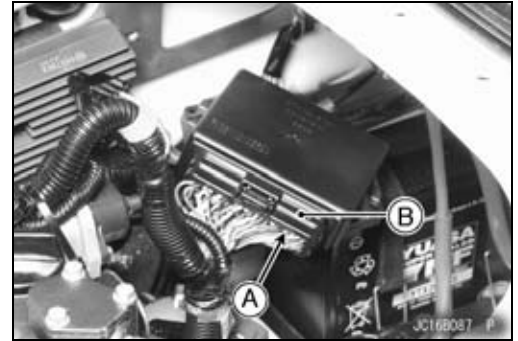
Insert the needle adapter straight along the terminal in the connector to prevent short-circuit between terminals.



DFI Servicing Precautions

○After measurement, remove the needle adapters and apply silicone sealant to the seals [A] of the connector [B] for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) -Seals of Connector



- Always check battery condition before replacing the DFI parts. A fully charged battery is a must for conducting accurate tests of the DFI system.
- Do not directly connect a 12 V battery to a fuel injector. Insert a resistor (5 ~ 7 Ω) or a bulb (12 V, 3 ~ 3.4 W) in series between the battery and the injector.

3-22 FUEL SYSTEM (DFI)

Self-Diagnosis

Self-diagnosis Outline

The self-diagnosis system has two modes and can be switched to another mode.

- [A] Push the “SET” button with “MODE” button at the same time for 3 seconds or more.
- [B] Push either “SET” or “MODE” button for more than one second or more.

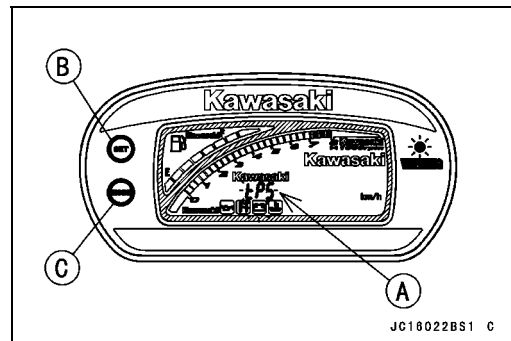
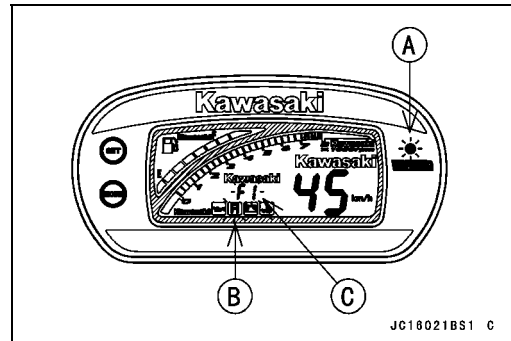
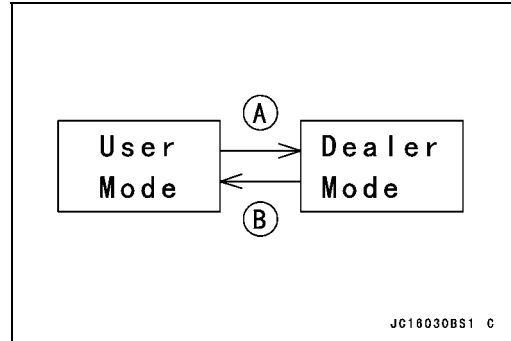
User Mode

This is a standard mode and enters automatically after ignition switch ON. The ECU notifies the rider of troubles in DFI system and ignition system by flashing LED warning light [A], the FI indicator [B] and “FI” character [C] when DFI system and ignition system parts are faulty, and initiates fail-safe function. The buzzer sound goes on. In case of serious troubles ECU stops the injection/ignition/starter motor operation. The buzzer sound can be stopped by pushing either “SET” or “MODE” button.

Dealer Mode

The LCD in the meter unit displays service code character [A] to show the problem(s) which the DFI system and ignition system has at the moment of diagnosis.

- To enter the dealer mode push the “SET” button [B] with “MODE” button [C] for 3 seconds or more.
- Read the service code character in the LCD display. Refer to the “Service Code (Character) Table” in the following section.
- To return the user mode push either “SET” or “MODE” button for one second or more.
- The service code character(s) will not be shown on the LCD in the meter unit after the problems are solved.



Self-Diagnosis

Service Code (Character) Table

Service Code (used in ECU)	Service Code Character (displayed on Meter Unit)	Possible Problems	Fail-Safe Function
11	TPS	Throttle sensor malfunction, wiring open or short	The ECU locks ignition timing into the ignition timing at closed throttle position and sets the DFI in the D-J method (see Note 1).
12	IPSt	Inlet air pressure sensor malfunction, wiring open or short	The ECU sets the DFI in the α -N method (see Note 2).
13	AITt	Inlet air temperature sensor malfunction, wiring open or short	The ECU sets the inlet air temperature at 40°C.
14	AWTt	Water temperature sensor malfunction, wiring open or short	The ECU sets the water temperature at 70°C.
21	CRAG	Crankshaft sensor malfunction, wiring open or short	—
23	CAAG	Camshaft position sensor malfunction, wiring open or short	The ECU continues to ignite cylinders in the same sequence following the last good signal.
31	IDS	Vehicle-down sensor malfunction, wiring open or short	The ECU slows down the engine speed less than 3 000 r/min (rpm) by stopping the ignition.
41	IN1	Injector #1 malfunction, wiring open or short	—
42	IN2	Injector #2 malfunction, wiring open or short	—
43	IN3	Injector #3 malfunction, wiring open or short	—
44	IN4	Injector #4 malfunction, wiring open or short	—
51	CO1	Ignition coil #1, #4 malfunction, wiring open or short	The ECU shuts off the injectors #1/#4 to stop fuel to the cylinders #1/#4.
52	CO2	Ignition coil #2, #3 malfunction, wiring open or short	The ECU shuts off the injectors #2/#3 to stop fuel to the cylinders #2/#3.
71	HEAT	Engine overheat	The ECU slows down the engine speed less than 3 000 r/min (rpm) by stopping the ignition.
72	OILP	Engine oil pressure too low	The ECU slows down the engine speed less than 3 000 r/min (rpm) by stopping the ignition.
73	(JT1500-A1) OILT	Oil temperature sensor malfunction, wiring open or short	The ECU sets the oil temperature at 60°C.
	(JT1500-A2 ~) OILT		The ECU slows down the engine speed less than 3 000 r/min (rpm) by stopping the ignition.
76	(JT1500-A2 ~) OILH	Engine oil overheat	The ECU slows down the engine speed less than 3 000 r/min (rpm) by stopping the ignition.

3-24 FUEL SYSTEM (DFI)

Self-Diagnosis

Note:

- (1) D-J Method: the DFI control method from medium to heavy engine load. When the engine load is light like at idling or low speed, the ECU determines the injection quantity by calculating from the throttle vacuum (vacuum sensor output voltage) and engine speed (crankshaft sensor output voltage).
- (2) α -N Method: As the engine speed increases, and the engine load turns middle to heavy, the ECU determines the injection quantity by calculating from the throttle opening (throttle sensor output voltage) and the engine speed.
- (3) If both throttle sensor system and inlet air pressure fails, the ECU locks ignition timing into the ignition timing at closed throttle position and sets the DFI in the α -N method.
- (4) The ECU may be involved in these problems. If all the parts and circuits checked out good, be sure to check the ECU for ground and power supply. If the ground and power supply are checked good, replace the ECU.

Memory of Service Code (Character)

The service codes (characters) in the past are stored in the ECU. However, the characters cannot be displayed in the meter. The past service codes can be confirmed by using the Kawasaki Diagnostic System (see General Information chapter), and they can be erased.

Troubleshooting the DFI System

Sample Diagnosis Sheet

Rider name:	Registration No. (license plate No.):	Year of initial registration:
Model:	Engine No.:	Hull No.:
Date problem occurred:	Mileage:	
Environment when problem occurred.		
Weather	<input type="checkbox"/> fine, <input type="checkbox"/> cloudy, <input type="checkbox"/> rain, <input type="checkbox"/> snow, <input type="checkbox"/> always, <input type="checkbox"/> other:	
Temperature	<input type="checkbox"/> hot, <input type="checkbox"/> warm, <input type="checkbox"/> cold, <input type="checkbox"/> very cold, <input type="checkbox"/> always	
Problem frequency	<input type="checkbox"/> chronic, <input type="checkbox"/> often, <input type="checkbox"/> once	
Altitude	<input type="checkbox"/> normal, <input type="checkbox"/> high (about 1 000 m or more)	
Watercraft conditions when problem occurred.		
Warning LED light, FI character, FI mark	<input type="checkbox"/> turn on immediately after ignition switch ON, and turn off after 1 ~ 2 seconds (normal).	
	<input type="checkbox"/> lights blink after ignition switch ON, and stay on (DFI problem)	
	<input type="checkbox"/> unlights (LED light, meter unit, ECU or its wiring fault).	
	<input type="checkbox"/> sometimes lights up (probably wiring fault).	
Starting difficulty	<input type="checkbox"/> starter motor not rotating.	
	<input type="checkbox"/> starter motor rotating but engine doesn't turn over.	
	<input type="checkbox"/> starter motor and engine don't turn over.	
	<input type="checkbox"/> no fuel flow (<input type="checkbox"/> no fuel in tank, <input type="checkbox"/> no fuel pump sound).	
	<input type="checkbox"/> engine flooded (do not crank engine with throttle opened, which promotes engine flooding).	
	<input type="checkbox"/> no spark.	
	<input type="checkbox"/> other:	
Engine stalls	<input type="checkbox"/> right after starting.	
	<input type="checkbox"/> when opening throttle lever.	
	<input type="checkbox"/> when closing throttle lever.	
	<input type="checkbox"/> when moving off.	
	<input type="checkbox"/> when stopping the watercraft.	
	<input type="checkbox"/> when cruising.	
	<input type="checkbox"/> other:	
Poor running at low speed	<input type="checkbox"/> very low idle speed, <input type="checkbox"/> very high idle speed, <input type="checkbox"/> rough idle speed.	
	<input type="checkbox"/> battery voltage is low (charge the battery).	
	<input type="checkbox"/> spark plug loose (tighten it).	
	<input type="checkbox"/> spark plug dirty, broken, or gap maladjusted (remedy it).	
	<input type="checkbox"/> backfiring.	
	<input type="checkbox"/> afterfiring.	
	<input type="checkbox"/> hesitation when acceleration.	
	<input type="checkbox"/> engine oil viscosity too high.	
	<input type="checkbox"/> engine overheating.	
<input type="checkbox"/> other:		

3-26 FUEL SYSTEM (DFI)

Troubleshooting the DFI System

Poor running or no power at high speed	<input type="checkbox"/> spark plug loose (tighten it).
	<input type="checkbox"/> spark plug dirty, broken, or gap maladjusted (remedy it).
	<input type="checkbox"/> spark plug incorrect (replace it).
	<input type="checkbox"/> knocking (fuel poor quality or incorrect).
	<input type="checkbox"/> engine overheating.
	<input type="checkbox"/> engine oil level too high.
	<input type="checkbox"/> engine oil viscosity too high.
	<input type="checkbox"/> other:

Throttle Sensor (Service Code/Character-11/tPS)

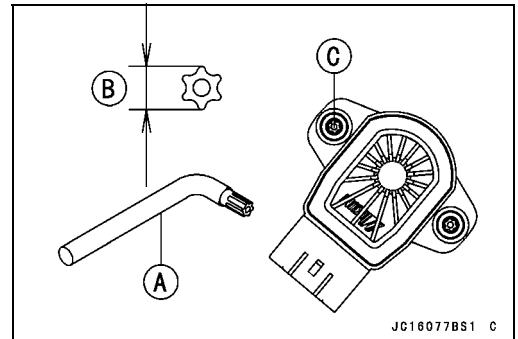
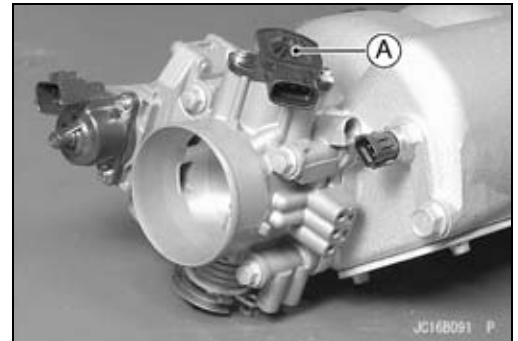
Throttle Sensor Removal/Adjustment

CAUTION
Never drop the throttle sensor [A], especially on a hard surface. Such a shock to the sensor can damage it.

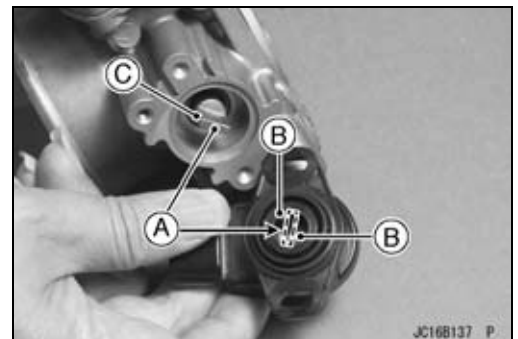
- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Air filter (see air Filter Removal)
- Use a Torx wrench [A] (T20, B = 3.86 mm (0.152 in.)) to remove the throttle sensor mounting screws [C].

NOTE

○ *In the engine compartment, there is not enough space between the throttle sensor and hull to remove the Torx screws. So use an L shape Torx wrench.*



- When installing the throttle sensor, note the following (In the photo, the throttle sensor has been removed from the throttle body for clarity).
- Align [A] the projections [B] on the throttle sensor with the throttle shaft [C] as shown when putting the throttle sensor to the throttle body.



- Turn the throttle sensor counterclockwise [A] a little and temporarily tighten the throttle sensor mounting screws.



3-28 FUEL SYSTEM (DFI)

Throttle Sensor (Service Code/Character-11/tPS)

- Adjust the throttle sensor positioning as follows.
- Install the air filter temporarily.
- After warming up the engine, check the idling speed.

Idle Speed

Standard: 1 300 ±100 r/min (rpm)

- Stop the engine and turn the ignition switch OFF.
- Disconnect the throttle sensor connector and connect the throttle sensor setting adapter [A] between the harness connector and throttle sensor connector.
- Connect a digital meter to the sensor setting adapter leads.

Special Tool - Throttle Sensor Setting Adapter: 57001-1521

Throttle Sensor Output Voltage

Connections to Sensor

Meter (+) → G/W lead

Meter (-) → BK/W lead

- Start the engine with idle speed.
- Turn [A] the throttle sensor and bring the sensor output voltage within the standard range.

Output Voltage at Sensor

Standard: 1.08 ~ 1.18 V DC (at idle throttle opening)

- Tighten the throttle sensor mounting screws.
- Torque - Throttle Sensor Mounting Screws: 2.0 N·m (0.20 kgm·f, 18 in·lb)**
- Recheck the sensor output voltage is within the standard range.
- Stop the engine and turn the ignition switch OFF.
- Remove the setting adapter and reconnect the throttle sensor connector.

Input Voltage Inspection

NOTE

○ Be sure the battery is fully charged.

- Turn the ignition switch OFF.
- Remove the ECU (see ECU Removal). Do not disconnect the ECU connector.
- Connect a digital voltmeter [A] to the connector [B], using the needle adapter set.

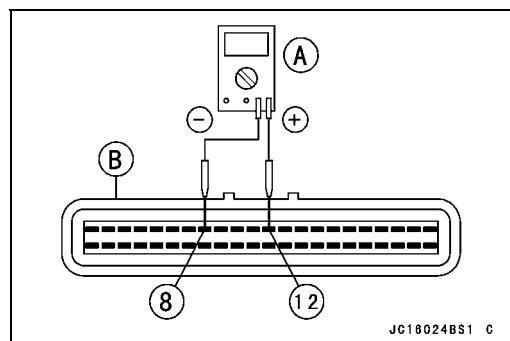
Special Tool - Needle Adapter Set: 57001-1457

Throttle Sensor Input Voltage

Connections to ECU

Meter (+) → R lead (terminal 12)

Meter (-) → BK/W lead (terminal 8)



Throttle Sensor (Service Code/Character-11/tPS)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.
- Wait 15 seconds before using the starter again.

Input Voltage at ECU

Standard: 4.75 ~ 5.25 V DC

- Turn the ignition switch OFF.
- ★ If the reading of input voltage is less than the standard, check the ECU for its ground, power supply and wiring shorted. If the ground, power supply and wiring are good, replace the ECU.
- ★ If the input voltage is within the standard range, check the input voltage at the throttle sensor connector.
- Remove the air filter temporarily (see Air Filter Removal).
- Disconnect the throttle sensor connector and connect the setting adapter [A] between the harness connector and throttle sensor connector.
- Connect a digital meter to the setting adapter leads.

Special Tool - Throttle Sensor Setting Adapter: 57001-1521

Throttle Sensor Input Voltage Connections to Sensor

Meter (+) → R lead

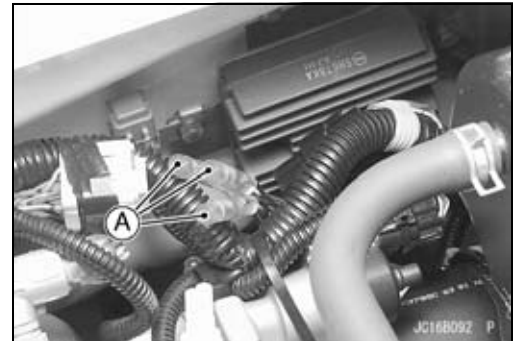
Meter (-) → BK/W lead

- Install the air filter.
- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.
- Wait 15 seconds before using the starter again.

Input Voltage at Sensor

Standard: 4.75 ~ 5.25 V DC

- Turn the ignition switch OFF.
- ★ If the reading is out of the range, check the wiring (see wiring diagram in this section).
- ★ If the reading is good, check the output voltage of the sensor.



3-30 FUEL SYSTEM (DFI)

Throttle Sensor (Service Code/Character-11/tPS)

Output Voltage Inspection

- Measure the output voltage at the ECU in the same way as input voltage inspection. Note the following.

Digital Voltmeter [A]

Connector [B]

Special Tool - Needle Adapter Set: 57001-1457

Throttle Sensor Output Voltage

Connections to ECU

Meter (+) → G/W lead (terminal 34)

Meter (-) → BK/W lead (terminal 8)

- Start the engine.
- Check idle speed to ensure throttle opening is correct.

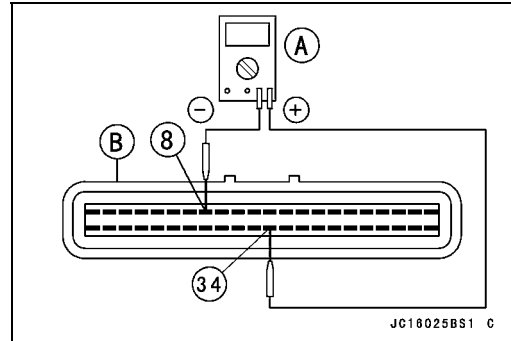
Idle Speed

Standard: 1 300 ±100 r/min (rpm)

- Measure the sensor output voltage with the idle speed.

Output Voltage at ECU

Standard: 1.08 ~ 1.18 V DC (at idle throttle opening)



CAUTION

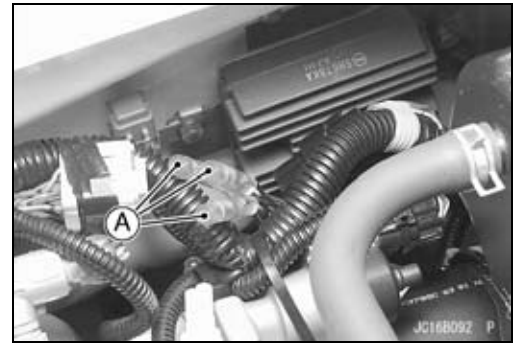
Never drop the throttle sensor can especially on a hard surface. A shock to the sensor can damage it.

- ★ If the output voltage is within the standard range, check the ECU for a good ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.
- ★ If the output voltage is far out of the standard range (e.g. when the wiring is open, the reading is 0 V), check the output voltage at the sensor connector.

Throttle Sensor (Service Code/Character-11/tPS)

- Disconnect the throttle sensor connector and connect the setting adapter [A] between the harness connector and throttle sensor connector.
- Connect a digital meter to the setting adapter leads.

Special Tool - Throttle Sensor Setting Adapter: 57001-1521



Throttle Sensor Output Voltage
Connections to Sensor
 Meter (+) → G/W lead
 Meter (-) → BK/W lead

- Measure the sensor output voltage with the idle speed.

Output Voltage at Sensor
 Standard: 1.08 ~ 1.18 V DC (at idle throttle opening)

CAUTION

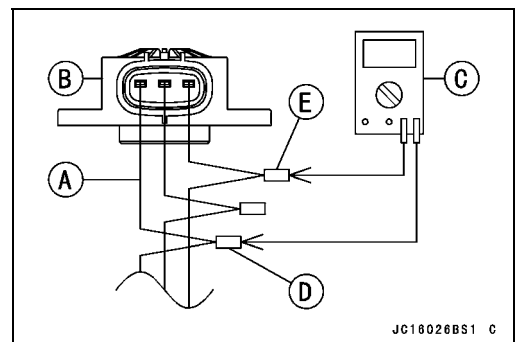
Never drop the throttle sensor, especially on a hard surface. A shock to the sensor can damage it.

- After throttle sensor voltage inspection, remove the setting adapter.
- ★ If the reading is out of the standard range, inspect the throttle sensor resistance.
- ★ If the output voltage is normal, check the wiring for continuity (see next diagram).

Resistance Inspection

- Turn the ignition switch OFF.
- Remove:
 - Air Filter (see Air Filter Removal)
- Disconnect the throttle sensor connector and connect the setting adapter [A] to the throttle sensor [B].

Special Tool - Throttle Sensor Setting Adapter: 57001-1521



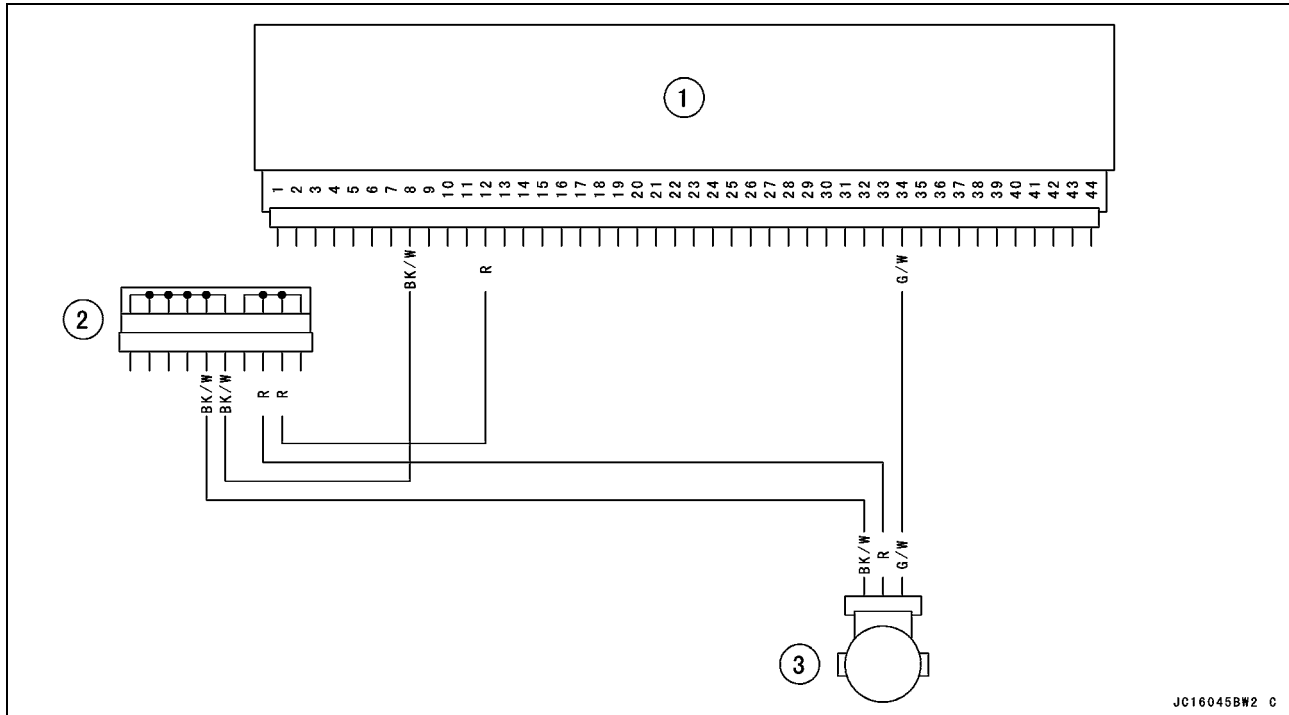
- Do not connect the harness connector.
- Connect a digital meter [C] to the harness adapter leads.
- Measure the throttle sensor resistance.

Throttle Sensor Resistance
Connections to
 Harness Adapter: R lead [D] ↔ BK/BL lead [E]
 Standard: 4 ~ 6 kΩ

- ★ If the reading is out of the range, replace the throttle body assy.
- ★ If the reading is within the range, but the problem still exists, replace the ECU.

3-32 FUEL SYSTEM (DFI)

Throttle Sensor (Service Code/Character-11/tPS)



JC16045BW2 C

- 1. ECU
- 2. Joint Connector E
- 3. Throttle Sensor

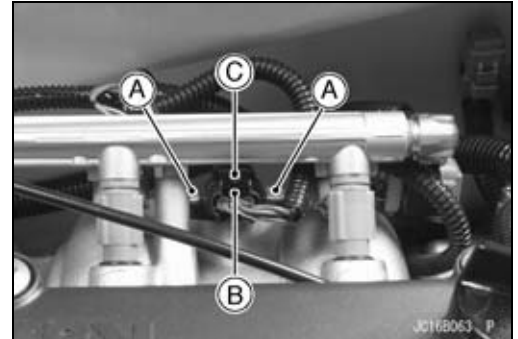
Inlet Air Pressure Sensor (Service Code/Character-12/bOST)

CAUTION

Never drop the sensor, especially on a hard surface. Such a shock to the part can damage it.

Inlet Air Pressure Sensor Removal

- Turn the ignition switch off.
- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Inlet Air Pressure Sensor Bolts [A]
 - Inlet Air Pressure Sensor Connector [B]
 - Inlet Air Pressure Sensor [C]

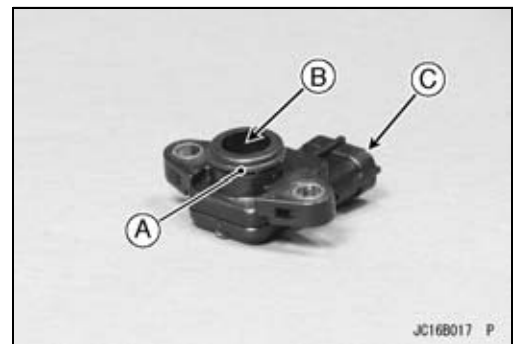


Inlet Air Pressure Sensor Installation

- Apply silicone oil to the O-ring [A].

CAUTION

Do not apply silicone oil to the sensor end (sensing part) [B] and the inside [C] of the sensor connector.



- Tighten:
 - Torque - Inlet Air Pressure Sensor Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

Input Voltage Inspection

NOTE

- Be sure the battery is fully charged.
- The inspection is the same as "Input Voltage Inspection" of the throttle sensor.

- Turn the ignition switch OFF.
- Remove the ECU (see ECU Removal). Do not disconnect the ECU connector.

- Connect a digital voltmeter [A] to the connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Inlet Air Pressure Sensor Input Voltage Connections to ECU

Meter (+) → R lead (terminal 12)

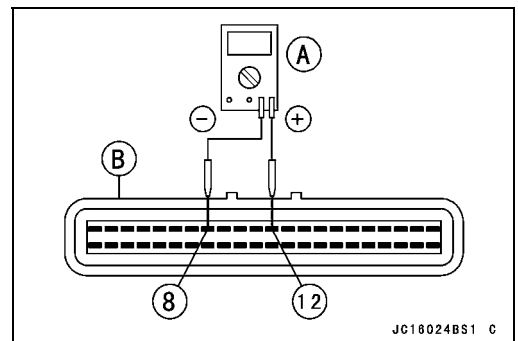
Meter (-) → BK/W lead (terminal 8)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.
- Wait 15 seconds before using the starter again.

Input Voltage at ECU

Standard: 4.75 ~ 5.25 V DC

- Turn the ignition switch OFF.
- ★ If the reading is less than the standard, check the ECU for its ground, power supply and wiring. If the ground, power supply and wiring are good, replace the ECU.



3-34 FUEL SYSTEM (DFI)

Inlet Air Pressure Sensor (Service Code/Character-12/b0St)

★If the reading is within the standard range, and check the input voltage at the sensor connector.

- Disconnect the inlet air pressure sensor connector and connect the harness adapter [A] between the harness connector and inlet air pressure sensor connector.
- Connect a digital meter to the harness adapter leads.
[B] Inlet Air Pressure Sensor

Special Tool - Sensor Harness Adapter: 57001-1561

Inlet Air Pressure Sensor Input Voltage

Connections to Sensor

Meter (+) → R lead [C]

Meter (-) → BK/W lead [D]

- Turn the ignition switch ON and push the lanyard key under the stop button.
 - Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.
- Wait 15 seconds before using the starter again.

Input Voltage at Sensor Connector

Standard: 4.75 ~ 5.25 V DC

- Turn the ignition switch OFF.
- ★If the reading is out of the standard range, check the wiring (see Wiring Diagram in this section).
- ★If the reading is good, the input voltage is normal. Check the output voltage.

Output Voltage Inspection

- Measure the output voltage at the ECU in the same way as input voltage inspection. Note the following.

Inlet Air Pressure Sensor Output Voltage

Connections to ECU

Meter (+) → G/R lead (terminal 33)

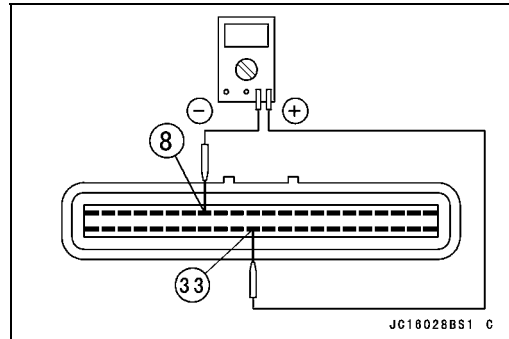
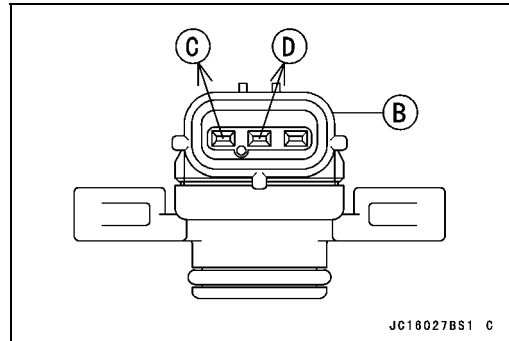
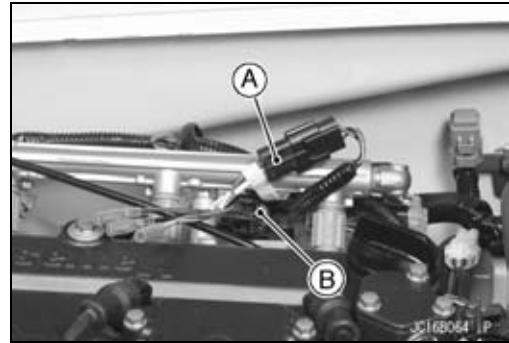
Meter (-) → BK/W lead (terminal 8)

Output Voltage at ECU

Usable Range: 3.75 ~ 4.25 V DC at the standard atmospheric pressure (101.32 kPa, 76 cmHg absolute)

NOTE

- The output voltage changes according to the local atmospheric pressure.
 - The vacuum sensor output voltage is based on a nearly perfect vacuum in the small chamber of the sensor. So, the sensor indicates absolute vacuum pressure.
- ★If the output voltage is within the usable range, check the ECU for its ground, power supply and wiring. If the ground, power supply and wiring are good, replace the ECU.



Inlet Air Pressure Sensor (Service Code/Character-12/bOSt)

- ★ If the output voltage is far out of the usable range, check the output voltage at the sensor connector [A].
- Measure the output voltage at the sensor in the same way as input voltage inspection. Note the following.
 - [B] Inlet Air Pressure Sensor

Special Tool - Sensor Harness Adapter: 57001-1561

Inlet Air Pressure Sensor Output Voltage Connections to Sensor

- Meter (+) → G/R lead [C]
- Meter (-) → BK/W lead [D]

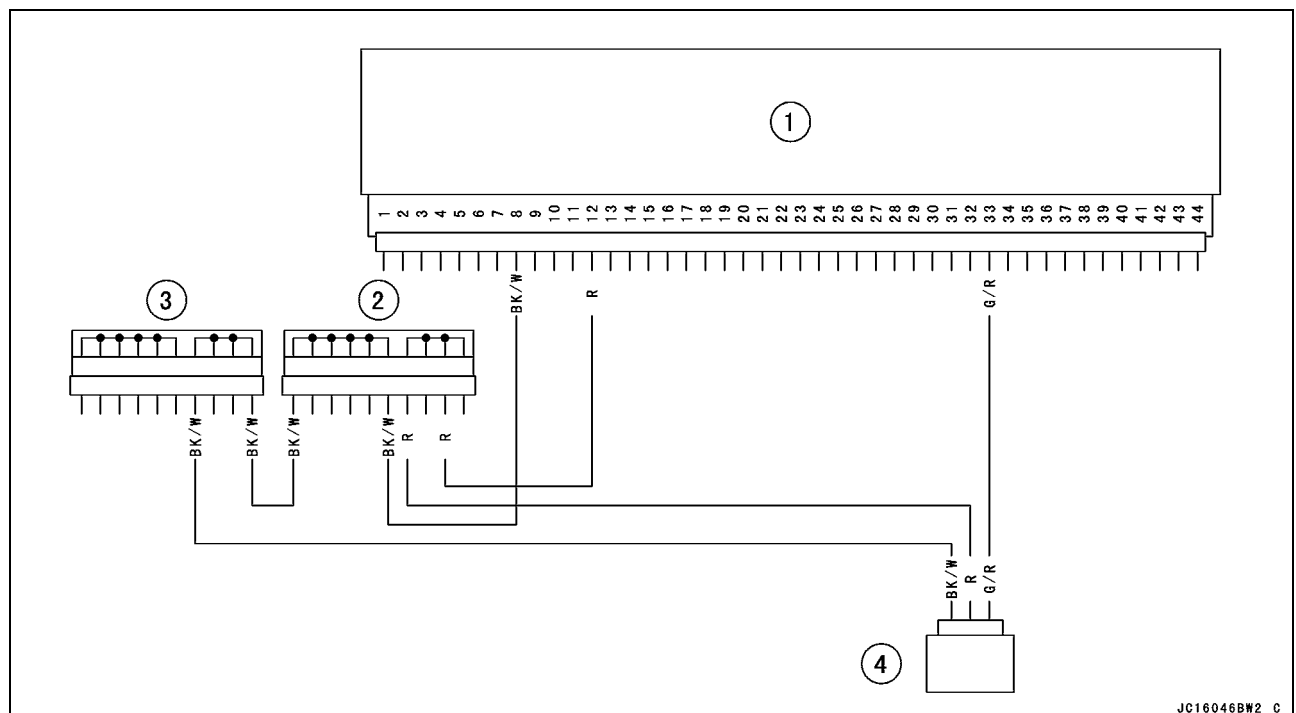
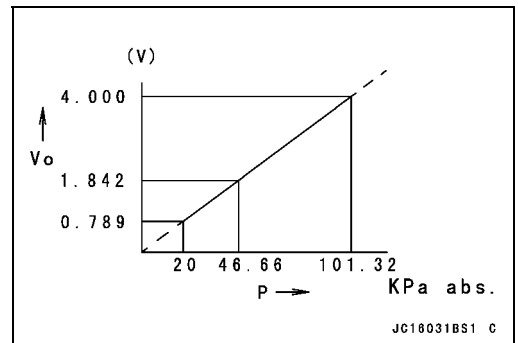
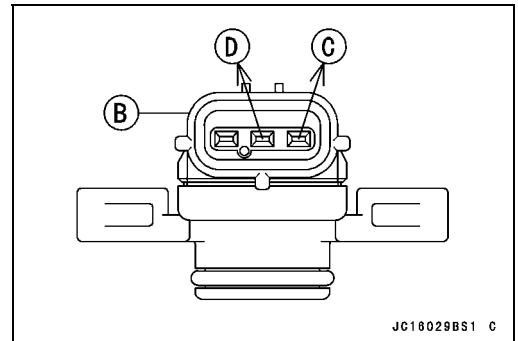
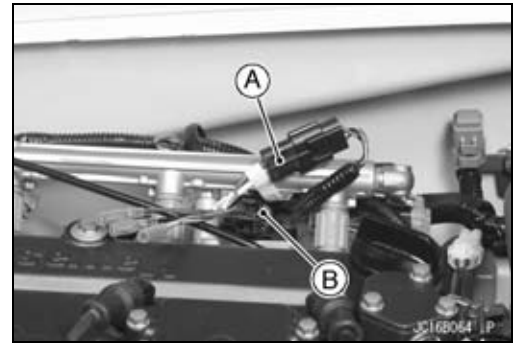
Output Voltage at Sensor Connector

Usable Range: 3.75 ~ 4.25 V DC at the standard atmospheric pressure (101.32 kPa or 76 cmHg absolute)

- ★ If the output voltage is normal, check the wiring for continuity (see next diagram).
- ★ If the output voltage is out of the usable range, replace the sensor.
- Turn the ignition switch OFF.
- Remove the sensor harness adapter.

Output Voltage Performance (at Input Voltage: 4.75 ~ 5.25 V)

P: Vacuum Pressure
Vo: Output Voltage



1. ECU
2. Joint Connector E

3. Joint Connector H
4. Inlet Air Pressure Sensor

3-36 FUEL SYSTEM (DFI)

Inlet Air Temperature Sensor (Service Code/Character-13/Airt)

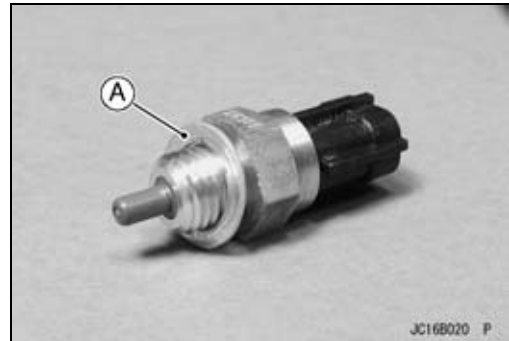
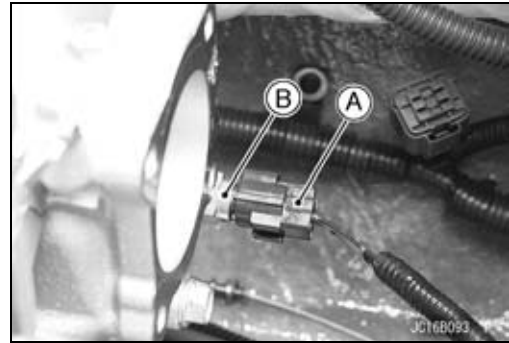
Inlet Air Temperature Removal/Installation

CAUTION

Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.

- Remove the air filter (see Air Filter Removal).
- Disconnect the connector [A] from the inlet air temperature sensor.
- Remove the inlet air temperature sensor [B] and washer.

- Install the inlet air temperature sensor and washer [A].
- Tighten:
Torque - Inlet Air Temperature Sensor: 20 N·m (2.0 kgf·m, 14 ft·lb)



Output Voltage Inspection

NOTE

○Be sure the battery is fully charged.

- Remove the ECU (see ECU Removal). Do not disconnect the ECU connector.
- Connect a digital voltmeter to the ECU connector, using needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Inlet Air Temperature Sensor Output Voltage Connections to ECU Connector

Meter (+) → R/BL lead (terminal 7)

Meter (-) → BK/W lead (terminal 8)

- Turn the ignition switch ON and push the lanyard key under the stop button.
 - Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.
- Wait 15 seconds before using the starter again.

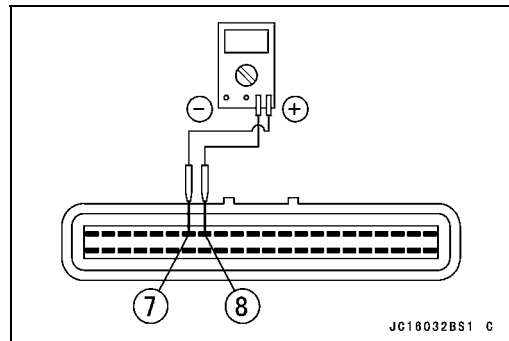
Output Voltage at ECU

Standard: about 2.3 ~ 2.6 V at inlet air temperature 20°C (68°F)

NOTE

○The output voltage changes according to the inlet air temperature.

- Turn the ignition switch OFF.



Inlet Air Temperature Sensor (Service Code/Character-13/Airt)

- ★ If the output voltage is out of the specified, check the ECU for its ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.
- ★ If the output voltage is far out of the specified, check the wiring (see next diagram).
- Remove the needle adapter set, and apply silicone sealant to the seals of the connector for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) -Seals of ECU Connectors

- ★ If the wiring is good, check the sensor resistance.

Sensor Resistance Inspection

- Remove the inlet air temperature sensor (see Inlet Air Temperature Sensor Removal).
- Suspend the sensor [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.
- Suspend a thermometer [B] with the heat-sensitive portion [C] located in almost the same depth with the sensor.

NOTE

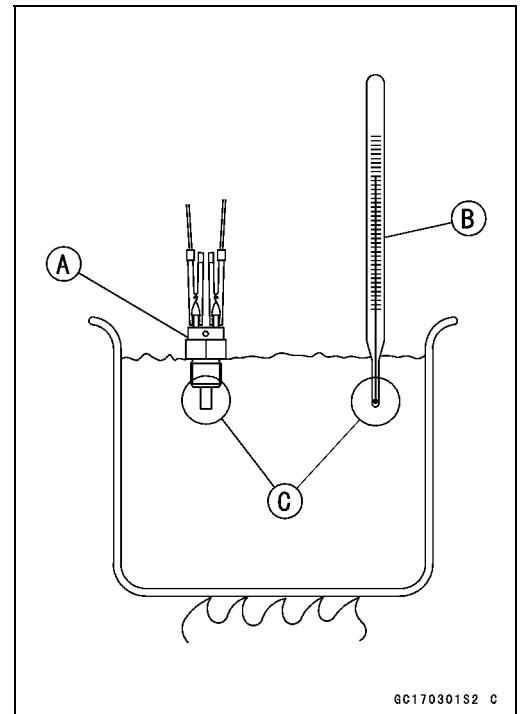
○ The sensor and thermometer must not touch the container side or bottom.

- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using a digital meter, measure the internal resistance of the sensor across the terminals at the temperatures shown in the table.

Inlet Air Temperature Sensor Resistance

Standard:	5.4 ~ 6.6 kΩ at 0°C (32°F)
	2.26 ~ 2.86 kΩ at 20°C (68°F)
	0.29 ~ 0.39 kΩ at 80°C (176°F)

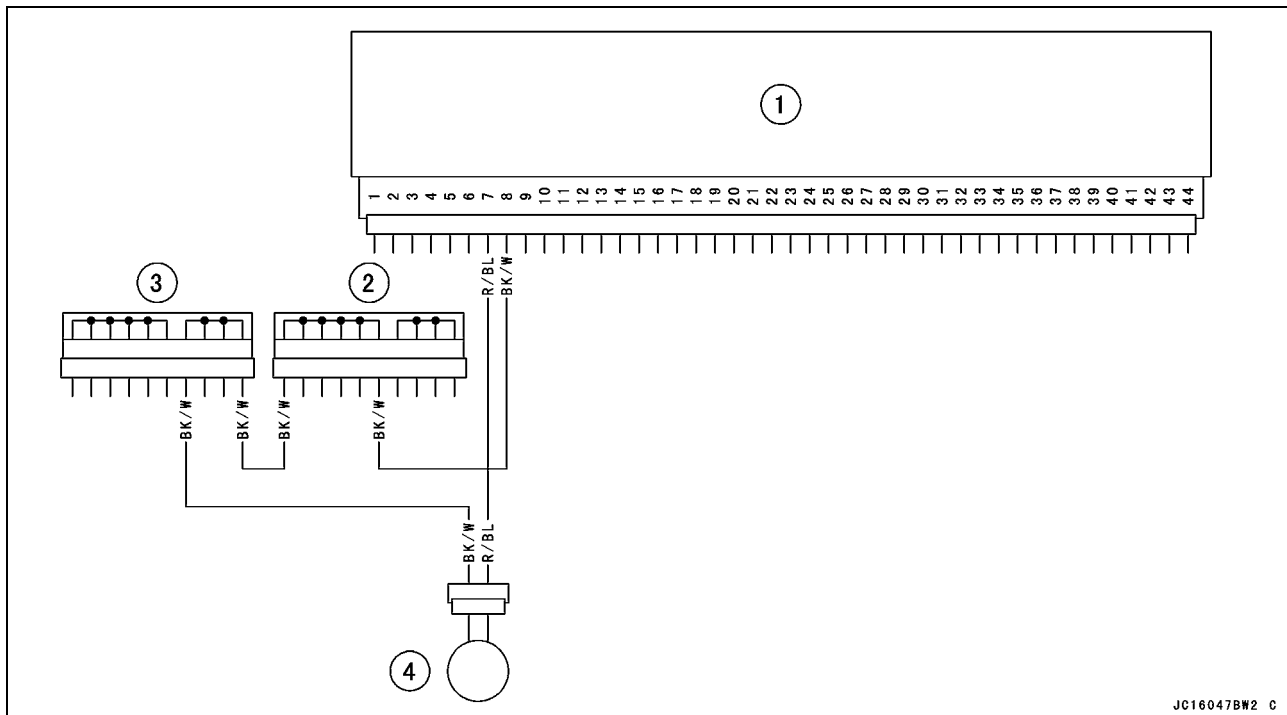
- ★ If the measurement is out of the range, replace the sensor.
- ★ If the measurement is within the specified, replace the ECU.



6G170301S2 C

3-38 FUEL SYSTEM (DFI)

Inlet Air Temperature Sensor (Service Code/Character-13/Airt)

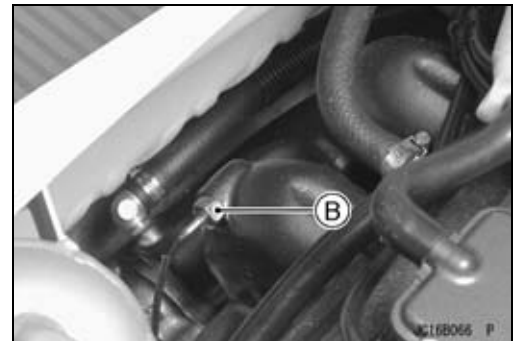
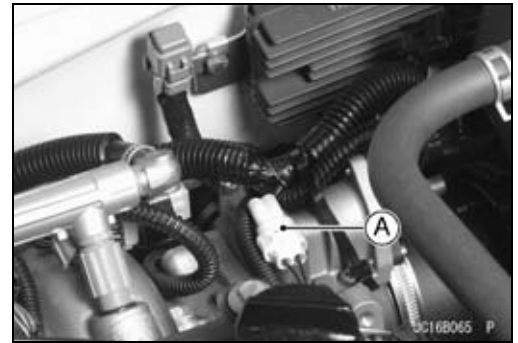


Water Temperature Sensor (Service Code/Character-14/AqUt)

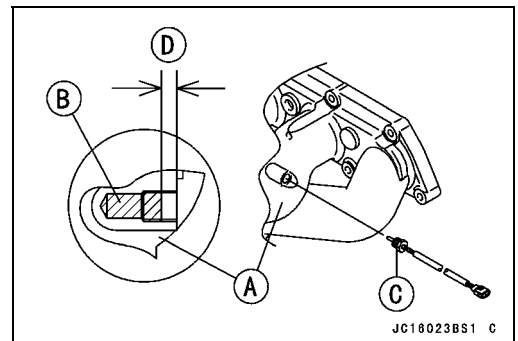
Water Temperature Sensor Removal/Installation

CAUTION
Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.

- Disconnect the sensor connector [A], and unscrew the water temperature sensor [B].



- When installing the water temperature sensor, remove the exhaust manifold for the engine oil filling in the hollow of the exhaust manifold.
- Fill the hollow of the exhaust manifold [A] with the engine oil (10W-30) [B] as shown, before installing the water temperature sensor [C].
[D] 5 mm (0.2 in.)
- Tighten:
Torque - Water Temperature Sensor: 15 N·m (1.5 kgf·m, 11 ft·lb)



Output Voltage Inspection

NOTE

○Be sure the battery is fully charged.

- Remove the ECU (see ECU Removal). Do not disconnect the connector.

3-40 FUEL SYSTEM (DFI)

Water Temperature Sensor (Service Code/Character-14/AqUt)

- Connect a digital voltmeter [A] to the ECU connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Water Temperature Sensor Output Voltage Connections to ECU

Meter (+) → G/Y lead (terminal 35)

Meter (-) → BK/W lead (terminal 8)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.
- Wait 15 seconds before using the starter again.

Output Voltage at ECU

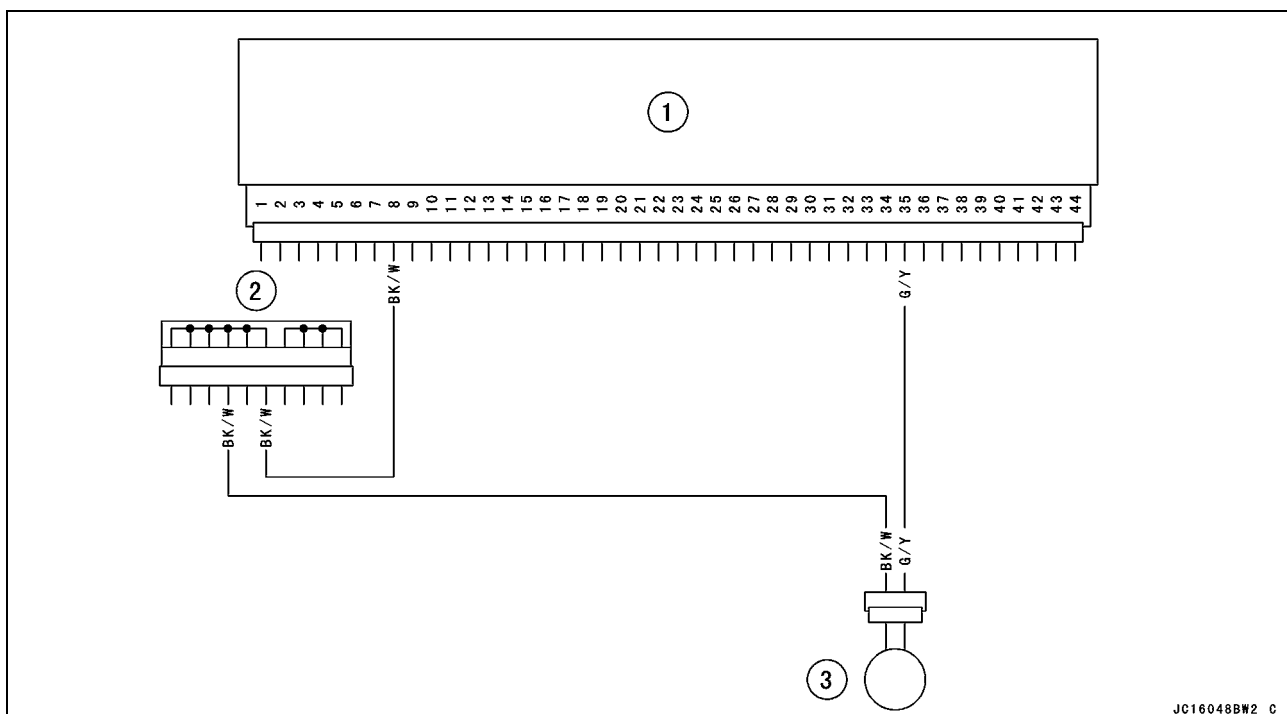
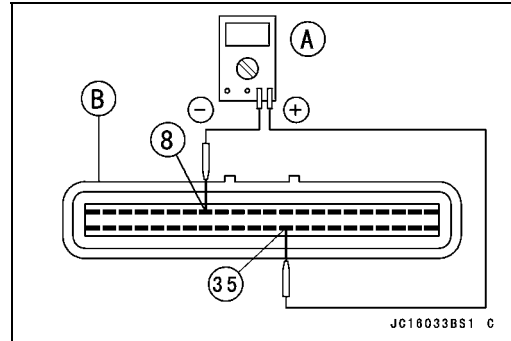
Standard: about 3 ~ 4 V at 20°C (68°F)

NOTE

○ The output voltage changes according to the coolant temperature in the engine.

- Turn the ignition switch OFF.
- ★ If the output voltage is out of the specified, check the ECU for its ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.
- ★ If the output voltage is far out of the specified (e.g. when the wiring is open, the voltage is about 5 V), check the wiring (see next diagram).
- ★ If the wiring is good, check the water temperature sensor resistance.
- Remove the needle adapter set, and apply silicone sealant to the seals of the connector for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) -Seals of ECU Connectors



Water Temperature Sensor (Service Code/Character-14/AqUt)

1. ECU
2. Joint Connector E
3. Water Temperature Sensor

Sensor Resistance Inspection

- Remove the water temperature sensor (see Water Temperature Sensor Removal/Installation).
- Refer to Electrical System chapter for water temperature sensor inspection.

3-42 FUEL SYSTEM (DFI)

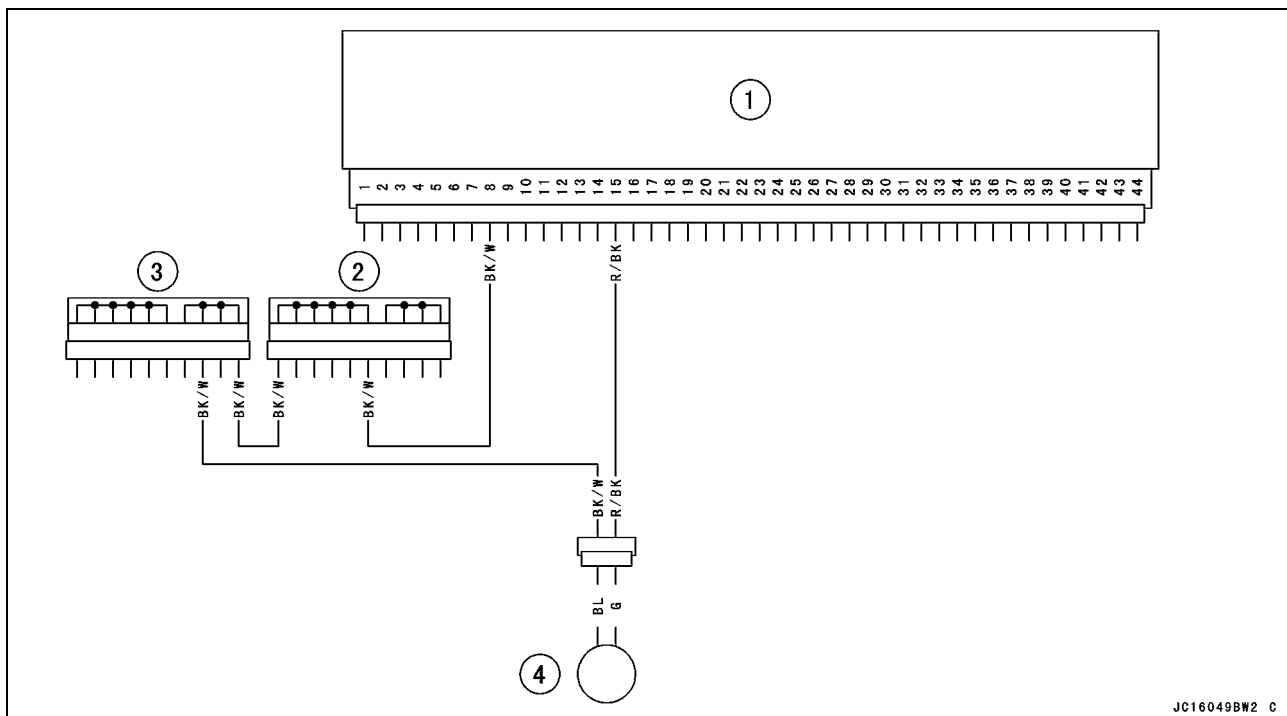
Crankshaft Sensor (Service Code/Character-21/CrAg)

Crankshaft Sensor Removal/Installation

- See the Ignition System section in Electrical System chapter.

Crankshaft Sensor Inspection

- The crankshaft has no power source, and when the engine stops, the crankshaft generates no signals.
- Crank the engine and measure the peak voltage of the crankshaft sensor (see Electrical System chapter) in order to check the sensor.
- Check the wiring for continuity, using the following diagram.



1. ECU
2. Joint Connector E
3. Joint Connector H
4. Crankshaft Sensor

Camshaft Position Sensor (Service Code/Character-23/CAAg)

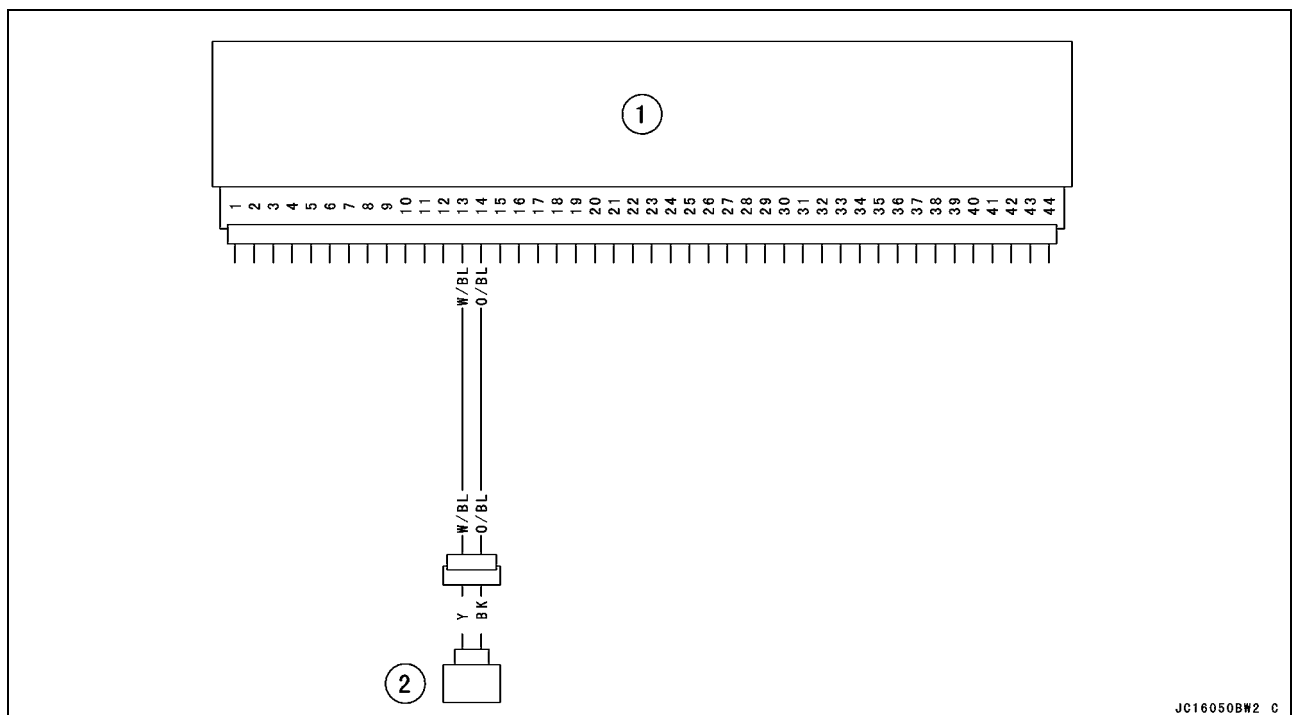
Camshaft Position Sensor Removal/Installation

The camshaft position sensor detects the position of the camshaft, and distinguishes the cylinder.

- See the Ignition system section in Electric System chapter.

Camshaft Position Sensor Inspection

- The camshaft position sensor have no power source, and when the engine stops, the camshaft position sensor generates no signal.
- Crank the engine and measure the peak voltage of the camshaft position sensor (see Electrical System chapter) in order to check the sensor.
- Check the wiring for continuity, using the following diagram.



- 1. ECU
- 2. Camshaft Position Sensor

3-44 FUEL SYSTEM (DFI)

Vehicle-down Sensor (Service Code/Character-31/dOS)

This sensor has a weight [A] with two magnets inside, and sends a signal to the ECU. But when the watercraft banks 110 ~ 130° or more to either side (in fact falls down), the weight turns and shuts off the signal. The ECU senses this change, and stops the fuel pump, the fuel injectors, and the ignition system.

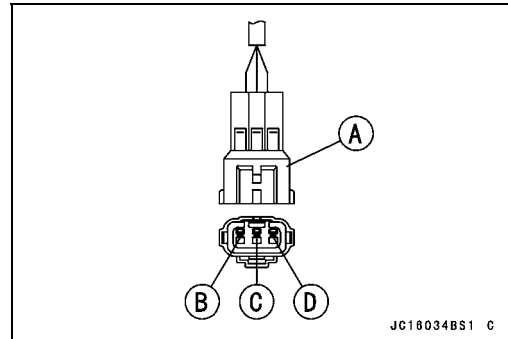
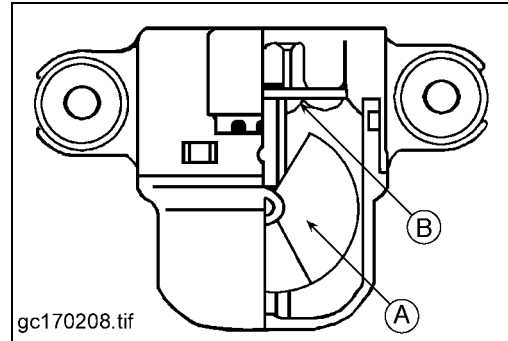
Hall IC [B]

Vehicle-down Sensor Connector [A]

Ground Terminal BK/W [B]

Output Terminal BL/W [C]

Power Source Terminal R/G [D]

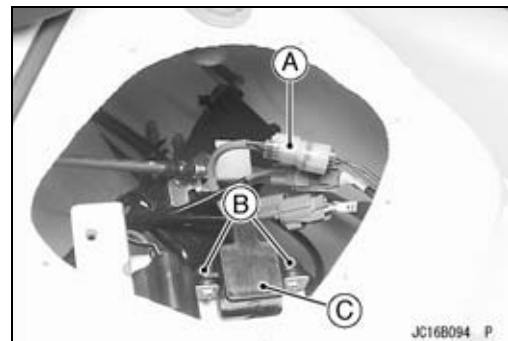
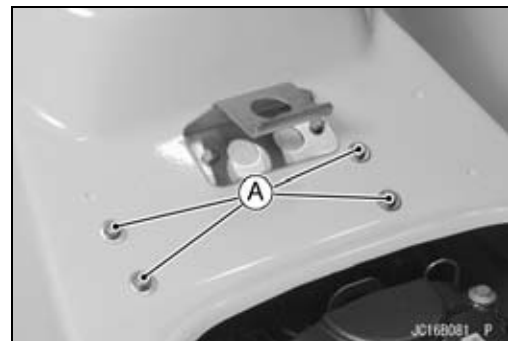


Vehicle-down Sensor Removal

CAUTION

Never drop the down-sensor, especially on a hard surface. Such a shock to the sensor can damage it.

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Front Storage Pocket (see Hull/Engine Hood chapter)
 - Bracket Bolts [A] and Washers
- Remove:
 - Vehicle-down Sensor Connector [A]
 - Screws [B]
 - Vehicle-down Sensor [C]



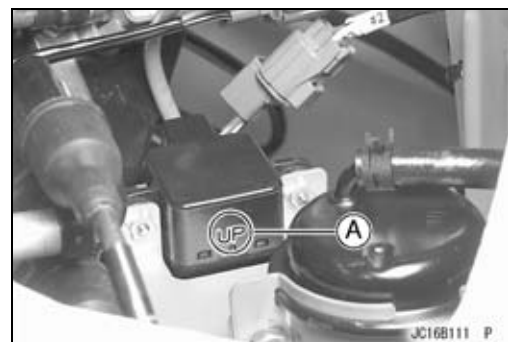
Vehicle-down Sensor Installation

- The UP mark [A] of the sensor should face upward.

⚠ WARNING

Incorrect installation of the vehicle-down sensor could cause sudden loss of engine power. The rider could lose balance during certain riding situations, like leaning over in a turn, with the potential for an accident resulting in injury or death. Ensure that the down sensor is held in place by the sensor brackets.

- Tighten:
 - Torque - Vehicle-down Sensor Mounting Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)



Vehicle-down Sensor (Service Code/Character-31/dOS)

Vehicle-down Sensor Inspection

NOTE

○Be sure the battery is fully charged.

- Remove:
 - Fuel Tank (see Fuel Tank Removal)
- Connect a digital volt meter [A] to the connector [B] of the vehicle-down sensor lead with the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Vehicle-down Sensor Power Source Voltage Connections to Sensor

- Meter (+) → R/G lead [D]
- Meter (-) → BK/W lead [E]

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor power source voltage.
- Wait 15 seconds before using the starter again.

Power Source Voltage at Sensor Standard: 4.75 ~ 5.25 V

- Turn the ignition switch OFF.
- ★If there is no standard voltage, check the following:
 - Battery (see Electrical System chapter)
 - Main Fuse 20 A
 - Wiring for Vehicle-down Sensor Power Source (see next diagram)
- ★If the power source is normal, check the output voltage.

- Turn the ignition switch OFF.
- Remove the vehicle-down sensor. Do not disconnect the connector.
- Connect a digital volt meter [A] to the connector, with needle adapter set [B].

Special Tool - Needle Adapter Set: 57001-1457

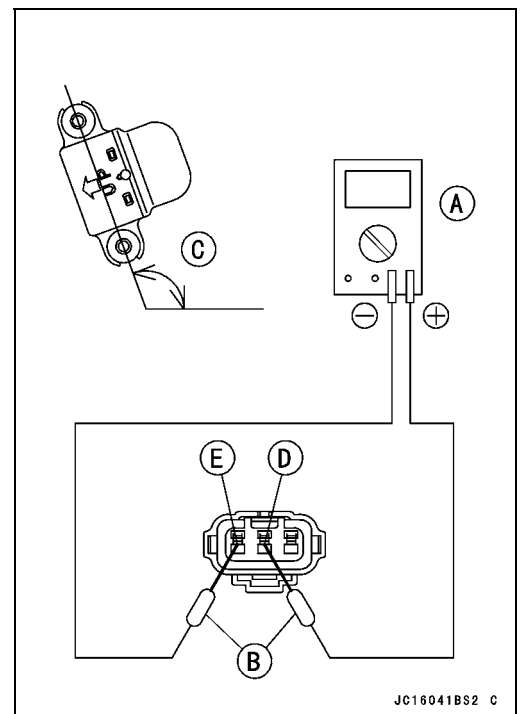
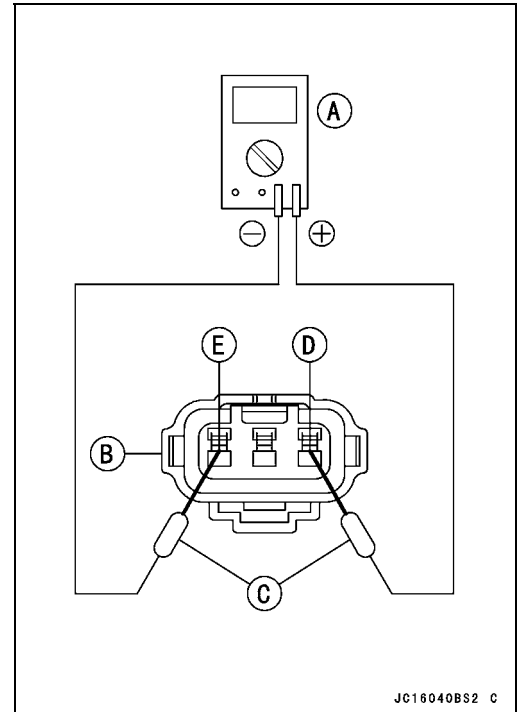
Vehicle-down Sensor Output Voltage Connections to Sensor

- Meter (+) → BL/W lead [D]
- Meter (-) → BK/W lead [E]

- Hold the sensor vertically.
- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.
- Tilt the sensor 110 ~ 130° or more [C] right or left, then hold the sensor and measure the output voltage.
- Wait 15 seconds before using the starter again.

Output Voltage at Sensor

- Standard:** with sensor tilted 110 ~ 130° or more right or left: 0.65 ~ 1.35 V
- with sensor arrow mark pointed up: 3.55 ~ 4.45 V



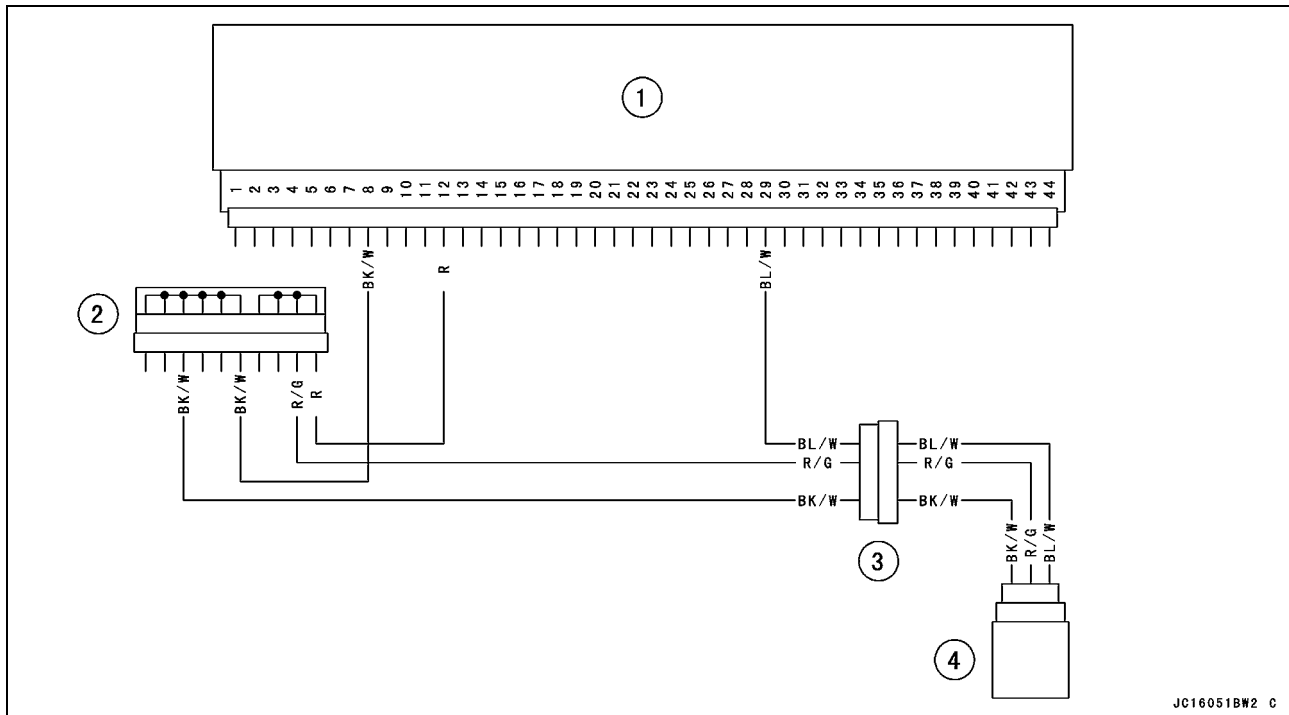
3-46 FUEL SYSTEM (DFI)

Vehicle-down Sensor (Service Code/Character-31/dOS)

- Turn the ignition switch OFF.
- Remove the needle adapter set, and apply silicone sealant to the seals of the connector for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) -Seals of Vehicle-down Sensor Connector

- ★ If the output voltage is normal, the wiring is suspect. Check the wiring.
- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.
- ★ If the output voltage is out of the specified, replace the vehicle-down sensor.



JC16051BW2 C

1. ECU
2. Joint Connector E
3. Connector C
4. Vehicle-down Sensor

Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

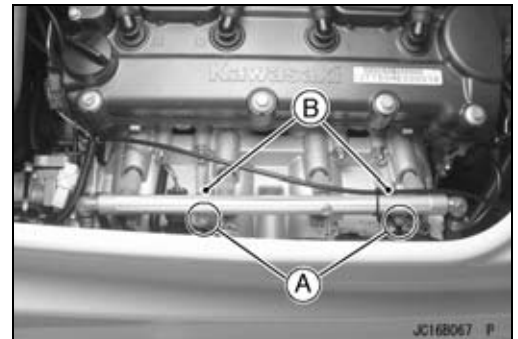
Fuel Injector Removal

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. Disconnect the battery (-) cable terminal. Do not smoke. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

Be prepared for fuel spillage: any spilled fuel must be completely wiped up immediately.

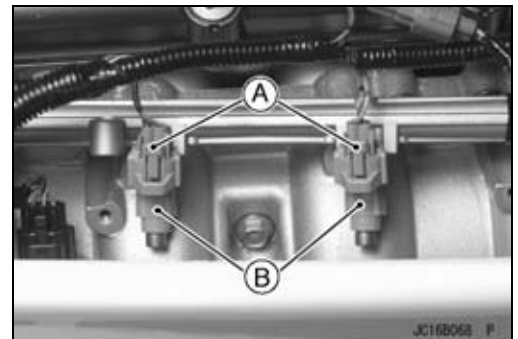
- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Fuel Hoses
 - Delivery Pipe Mounting Bolts [A], Collars [B] and Clamps
- Remove the delivery pipe assembly from the cylinder head.



- Push the lock [A] and disconnect the injector connectors.
- Remove the fuel injectors [B].

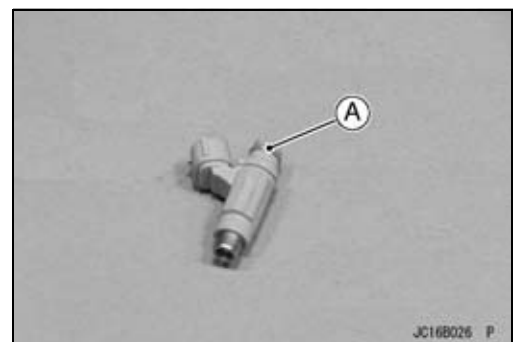
CAUTION

Never drop the injector, especially on a hard surface. Such a shock to the injector can damage it.



Fuel Injector Installation

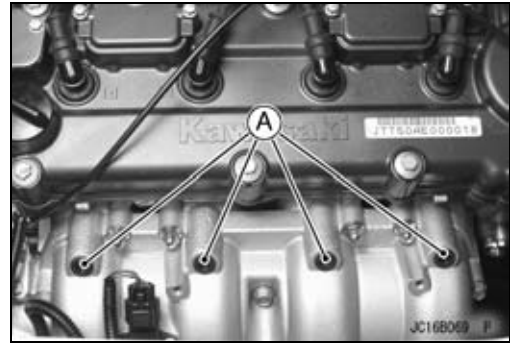
- Replace the O-rings [A] of the injectors with new ones.
- Apply grease to the O-rings.
- Insert the injectors into the delivery pipe and confirm whether they turn smoothly or not.



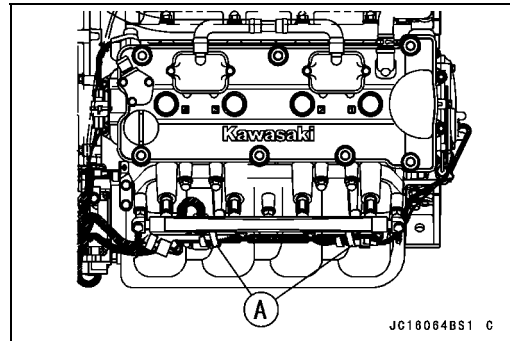
3-48 FUEL SYSTEM (DFI)

Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

- Replace the seals [A] with new ones.
- Apply grease to the inside and outside of seals.

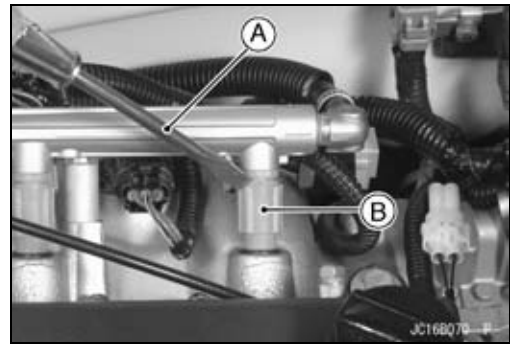


- Install:
 - Delivery Pipe Assembly
 - Collars
- Install the clamps [A] as shown.
- Tighten:
 - Torque - Delivery Pipe Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)**
- Install the fuel hoses (see Cable, Wire, and Hose Routing section in Appendix chapter).
- For JT1500-A2 model ~; Replace the double spring clamps with new ones. (see Fuel System Diagram)



Audible Inspection

- Start the engine.
- Apply the tip of a screwdriver [A] to the injector [B]. Put the grip end onto your ear, and listen whether the injector is clicking or not.
- A sound scope can also be used.
- Do the same for the other injector.
- ★ If all the injectors click at a regular intervals, the injectors are good.
- The click interval becomes shorter as the engine speed rises.
- ★ If either injector doesn't click, perform the "Injector Signal Test" for injector operation.

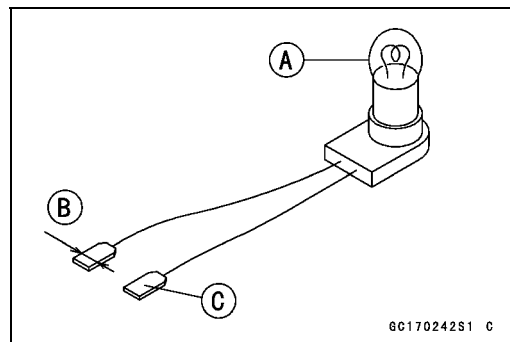


Injector Signal Test

- Prepare four test lights set with male terminals as shown.
 - Rating of Bulb [A]: 12 V, 3 ~ 3.4 W
 - Terminal Width [B]: 1.8 mm (0.07 in.)
 - Terminal Thickness [C]: 0.8 mm (0.03 in.)

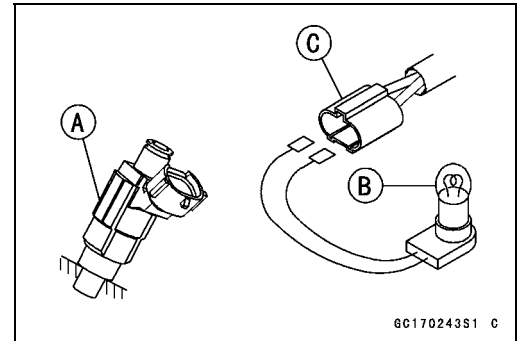
CAUTION

Do not use larger terminals than specified above. A larger terminal could damage the injector main harness connector (female), leading to harness repair or replacement.



Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

- Remove connectors for injector [A].
- Connect each test light set [B] to the injector harness connector [C].
- Turn the ignition switch ON.
- While cranking the engine with the starter motor, watch the test lights.
- ★ If the test lights flicker at regular intervals, the injector circuit in the ECU, and the wiring are good. Perform the "Injector Resistance Inspection".



○ Injector signals can be also confirmed by connecting the hand tester ($\times 10$ V AC) instead of the test light set to the injector harness (female) connector. Crank the engine with the starter motor, and check to see if the hand oscillates at regular intervals.

Special Tool - Hand Tester: 57001-1394

- ★ If the test light doesn't flicker (or the test hand doesn't oscillates), check the wiring and connectors again. If the wiring is good, check the injector voltage.

Injector Resistance Inspection

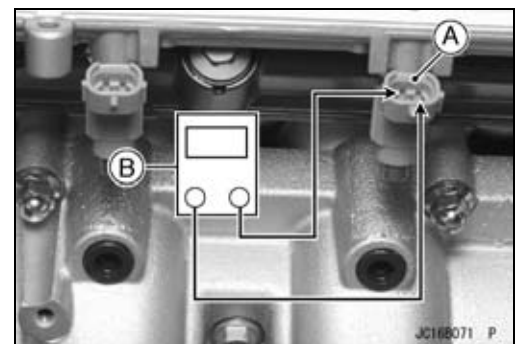
- Remove the delivery pipe assembly.
- Disconnect the connector from the injector [A].
- Measure the injector resistance with the hand tester [B].

Special Tool - Hand Tester: 57001-1394

Injector Resistance

Standard: about 11.7 ~ 12.3 Ω @20°C (68°F)

- ★ If the reading is out of the range, perform the "Injector Unit Test".
- ★ If the reading is normal, perform the "Injector Unit Test" for confirmation.



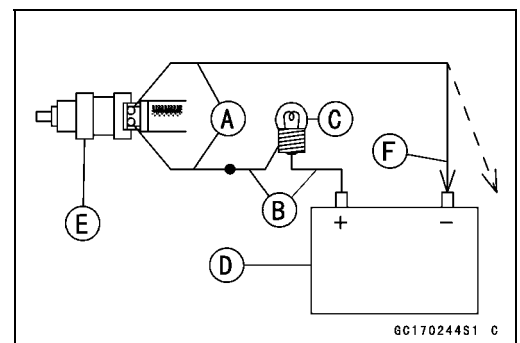
Injector Unit Test

- Use two leads [A] and the same test light set [B] as in "Injector Signal Test".
- Rating of Bulb [C]: 12 V, 3 ~ 3.4 W
- 12 V Battery [D]

CAUTION

Be sure to connect the bulb in series. The bulb works as a current limiter to protect the solenoid in the injector from excessive current.

- Connect the test light set to the injector [E] as shown.
- Open and connect [F] the end of the lead to the battery (-) terminal repeatedly. The injector should click.
- ★ If the injector does not click, replace the injector.



3-50 FUEL SYSTEM (DFI)

Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

Injector Voltage Inspection

- Turn the ignition switch OFF.
- Connect a digital voltmeter [A] to the connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Injector Power Source Voltage

Connector to Injector #1, #2, #3, #4

Meter (+) → R/Y lead

Meter (-) → Battery (-) Terminal

- Turn the ignition switch ON and push the lanyard key under the stop button.
 - Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the injector power source voltage.
- Wait 15 seconds before using the starter again.

Power Source Voltage at Injector Connector

Standard: Battery Voltage

- ★ If the power source voltage is less than standard, check the wiring (see Wiring Diagram in this section), relay (Main Relay Inspection) and ECU power source (see ECU Power Supply Inspection).

- Remove the ECU. Do not disconnect the connector.
- Connect a digital voltmeter [A] to the connector [B], with the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Injector Output Voltage

Connections to Injector #1

Meter (+) → PU lead (terminal 43)

Meter (-) → Battery (-) Terminal

Connections to Injector #2

Meter (+) → O lead (terminal 38)

Meter (-) → Battery (-) Terminal

Connections to Injector #3

Meter (+) → BR lead (terminal 39)

Meter (-) → Battery (-) Terminal

Connections to Injector #4

Meter (+) → BL/Y lead (terminal 40)

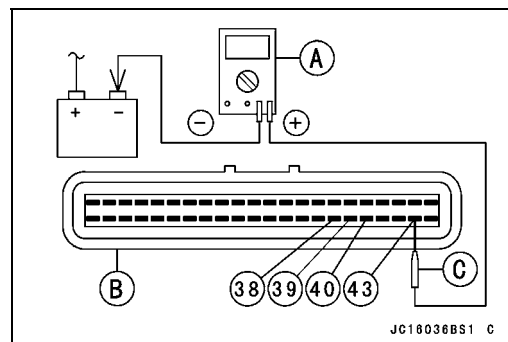
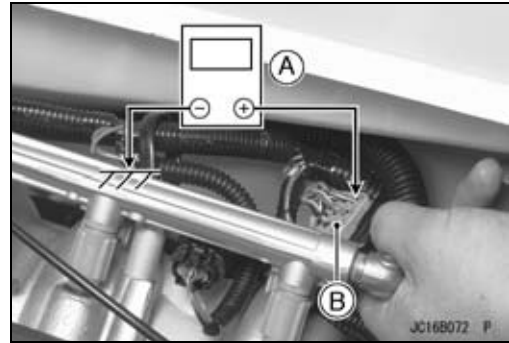
Meter (-) → Battery (-) Terminal

- Turn the ignition switch ON and push the lanyard key under the stop button.
 - Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the output voltage.
- Wait 15 seconds before using the starter again.

Output Voltage at Injector Connector

Standard: about 9 V or more

- ★ If the output voltage is out of the standard, replace the ECU.



Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

Injector Fuel Line Inspection

- Check the injector fuel line for leakage as follows:
 - Connect a commercially available vacuum/pressure pump [A] to the supply joint of the delivery pipe [B] with the fuel hose [C] (both ends connected with the clamps [D]) as shown.
 - Plug the return joint of the delivery pipe with a rubber plug [E].
 - Tighten the clamp [F].
 - Apply soap and water solution to the areas [G] as shown.
 - Watching the pressure gauge, squeeze the pump lever [H], and build up the pressure until the pressure reaches the maximum pressure.

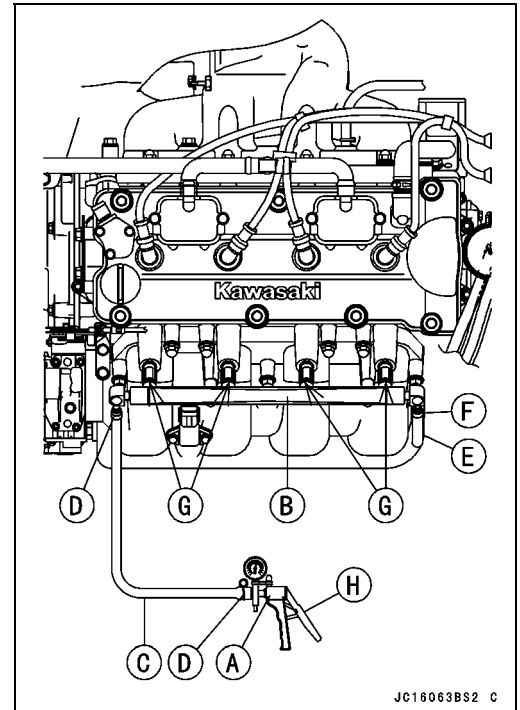
Fuel Line Maximum Pressure

Standard: 300 kPa (3.06 kgf/cm², 44 psi)

CAUTION

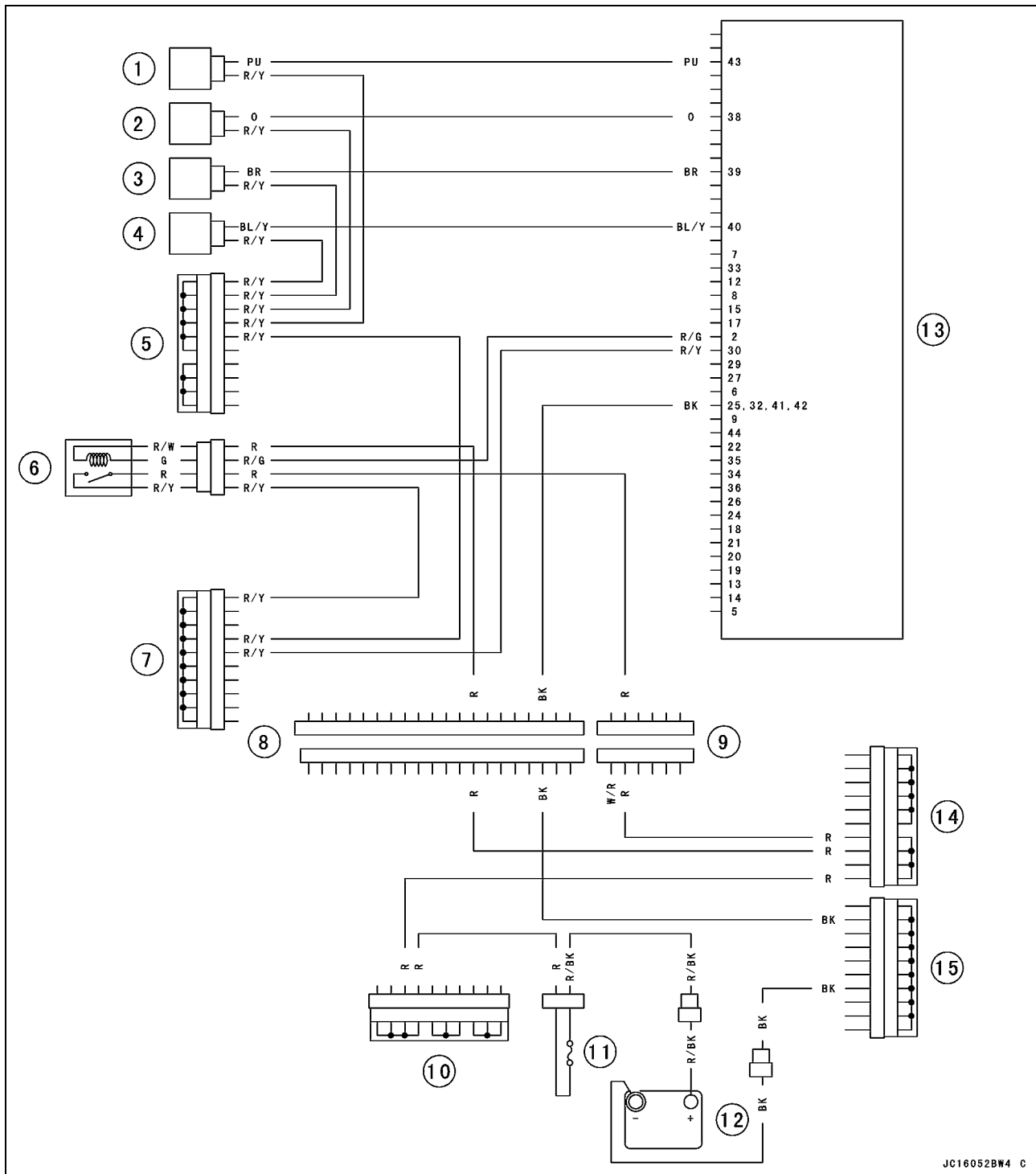
During pressure testing, do not exceed the maximum pressure for which the system is designed.

- Watch the gauge for at least 6 seconds.
- ★ If the pressure holds steady, the system is good.
- ★ If the pressure drops at once, or if bubbles are found in the area, the line is leaking. Replace the delivery pipe, injectors and related parts.
- Repeat the leak test, and check the fuel line for no leakage.
- Run the hoses correctly (see Cable, Wire, and Hose Routing section in Appendix chapter).
- For JT1500-A2 model ~; Replace the double spring clamps with new ones. (see Fuel System Diagram)



3-52 FUEL SYSTEM (DFI)

Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)



- 1. Fuel Injector #1
- 2. Fuel Injector #2
- 3. Fuel Injector #3
- 4. Fuel Injector #4
- 5. Joint Connector H
- 6. Main Relay in Relay Assembly
- 7. Joint Connector F
- 8. Connector C

- 9. Connector D
- 10. Joint Connector R
- 11. Main Fuse 20 A
- 12. Battery
- 13. ECU
- 14. Joint Connector P
- 15. Joint Connector S

Ignition Coils (Service Code/Character-51, 52/COL1, COL2)

Ignition Coil #1, #4: Service Code 51-COL1

Ignition Coil #2, #3: Service Code 52-COL2

Ignition Coil Removal/Installation

CAUTION

Never drop the ignition coils, especially on a hard surface. Such a shock to the ignition coil can damage it.

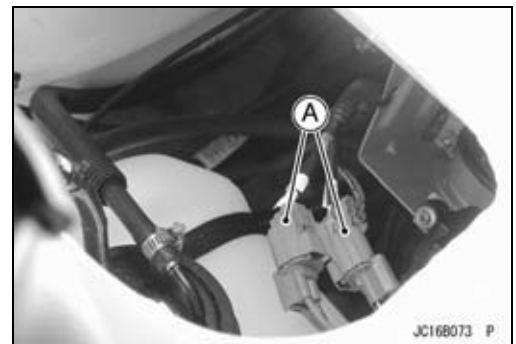
- See Ignition System section in Electrical System chapter.

Input Voltage Inspection

NOTE

○Be sure the battery is fully charged.

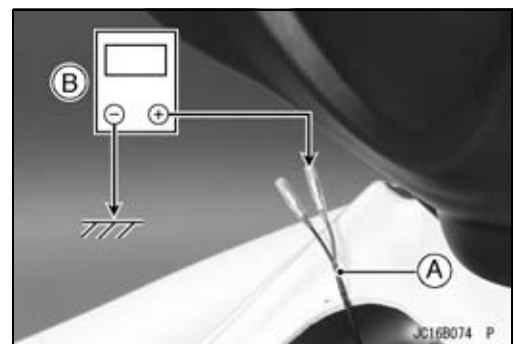
- Turn the ignition switch OFF.
- Remove:
 - Front Storage Pocket (see Hull/Engine Hood chapter)
- Disconnect the ignition coil primary lead connector(s) [A].



- Connect the harness adapter [A] and a digital voltmeter [B].

Special Tool - Harness Adapter: 57001-1562

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the input voltage.
- Wait 15 seconds before using the starter again.



Ignition Coil Input Voltage at Ignition Coil

Connections for Ignition Coil #1, #4

Meter (+) → R/Y lead

Meter (-) → Battery (-) terminal

Connections for Ignition Coil #2, #3

Meter (+) → R/Y lead

Meter (-) → Battery (-) terminal

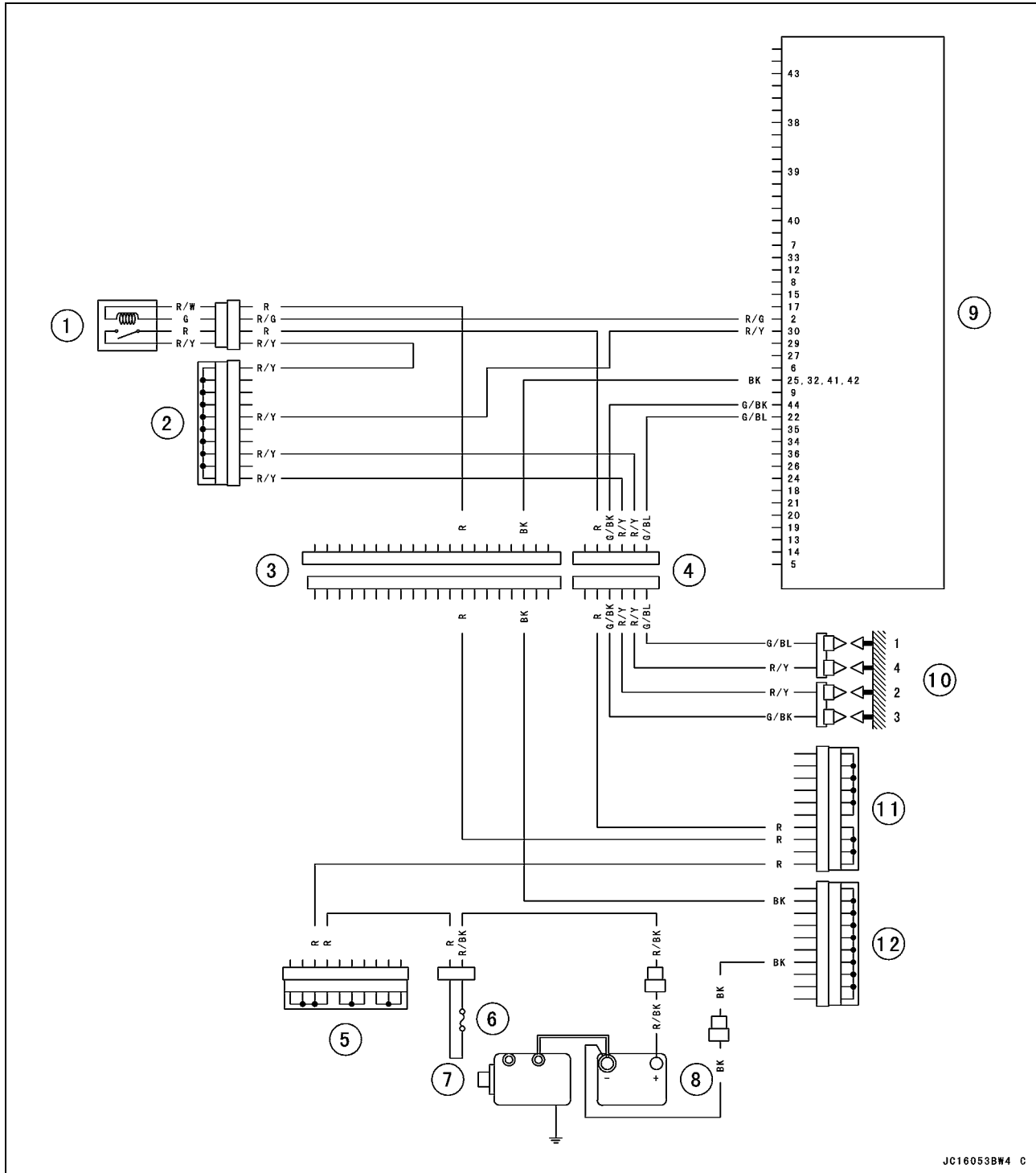
Input Voltage at ECU

Standard: Battery Voltage

- ★ If the reading is out of the standard, check the wiring (see next wiring diagram).
- ★ If the reading is good, the input voltage is normal. Crank the engine, and check the peak voltage of the ignition coils (see Electrical System chapter) in order to check the primary coils.

3-54 FUEL SYSTEM (DFI)

Ignition Coils (Service Code/Character-51, 52/COL1, COL2)



JC16053BW4 C

1. Main Relay in Relay Assembly
2. Joint Connector F
3. Connector C
4. Connector D
5. Joint Connector R
6. Main Fuse 20 A
7. Starter Motor
8. Battery
9. ECU
10. Ignition Coils
11. Joint Connector P
12. Joint Connector S

Engine Overheating (Service Code/Character-71/HEAt)

- If the service code is displayed, check the doubtful parts referring to the following table.

Possible Causes	Action (Chapter)
Water passage clogged, loosened or damaged	Inspect (see 9 chapter)
Incorrect engine oil level	Inspect (see 4 chapter)
Engine oil poor quality or incorrect	Change (see 4 chapter)
Water temperature sensor broken	Inspect (see 3 and 14 chapters)
Jet pump or impeller damaged	Inspect (see 11 chapter)
Oil cooler clogged	Clean (see 4 chapter)
Carbon build-up on combustion chamber	Clean (see 6 chapter)

3-56 FUEL SYSTEM (DFI)

Low Engine Oil Pressure (Service Code/Character-72/OILP)

- If the service code is displayed, check the doubtful parts referring to the following table.

Possible Causes	Action (Chapter)
Oil leak	Inspect (see 4 chapter)
Engine oil level too low	Inspect (see 4 chapter)
Engine oil viscosity too low	Inspect (see 4 chapter)
Oil filter clogged	Clean (see 4 chapter)
Oil pressure switch damaged	Inspect (see 3 and 14 chapters)
Oil cooler clogged	Inspect (see 4 chapter)
Camshaft bearing worn	Inspect (see 6 chapter)
Crankshaft bearing worn	Inspect (see 8 chapter)
Oil pressure relief valve stuck open	Change (see 4 chapter)
Oil pump damaged	Change (see 4 chapter)
Oil screen clogged	Clean (see 4 chapter)
O-ring at the oil passage in the crankcase damaged	Change (see 4 chapter)

Oil Temperature Sensor (Service Code/Character-73/OILC or 73/OILt)

Service Code/Character

JT1500-A1: 73/OILC

JT1500-A2 ~: 73/OILt

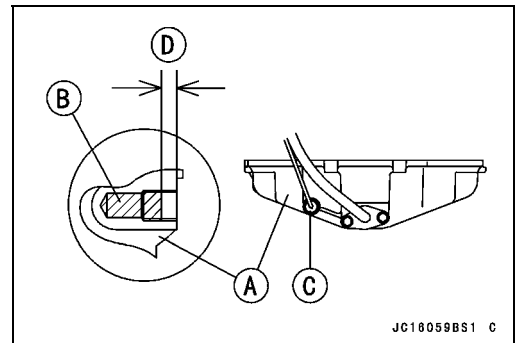
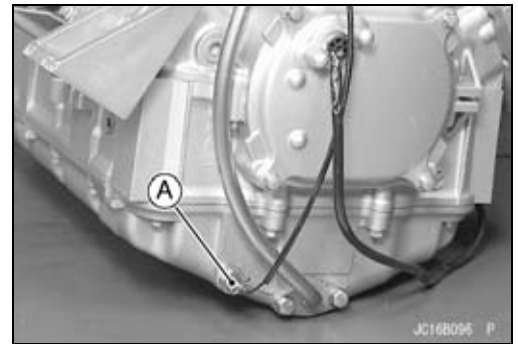
Oil Temperature Sensor Removal/Installation

CAUTION

Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.

- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Oil Temperature Sensor [A]

- Fill the hollow of the oil pan [A] with the specified silicone grease [B] as shown, before installing the oil temperature sensor [C].
 - [D] 5 mm (0.2 in.)
 - Silicone Grease-Kawasaki Bond: 92137-1002**
- Tighten:
 - Torque - Oil Temperature Sensor: 15 N·m (1.5 kgf·m, 11 ft·lb)**



Output Voltage Inspection

NOTE

○Be sure the battery is fully charged.

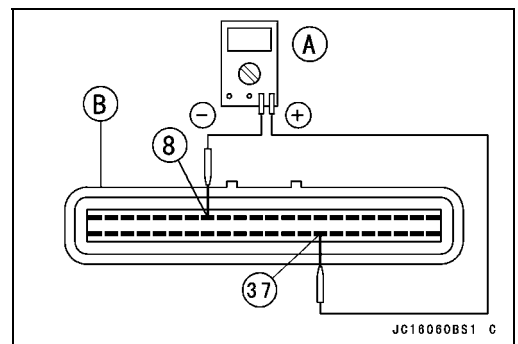
- Remove the ECU (see this chapter). Do not disconnect the connector.
- Connect a digital voltmeter [A] to the ECU connector [B], with the needle adapter set.
 - Special Tool - Needle Adapter Set: 57001-1457**

Water Temperature Sensor Output Voltage Connections to ECU

Meter (+) → Y lead (terminal 37)

Meter (-) → BK/W lead (terminal 8)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.
- Wait 15 seconds before using the starter again.



Output Voltage at ECU

Standard: about 3 ~ 4 V at 20°C (68°F)

NOTE

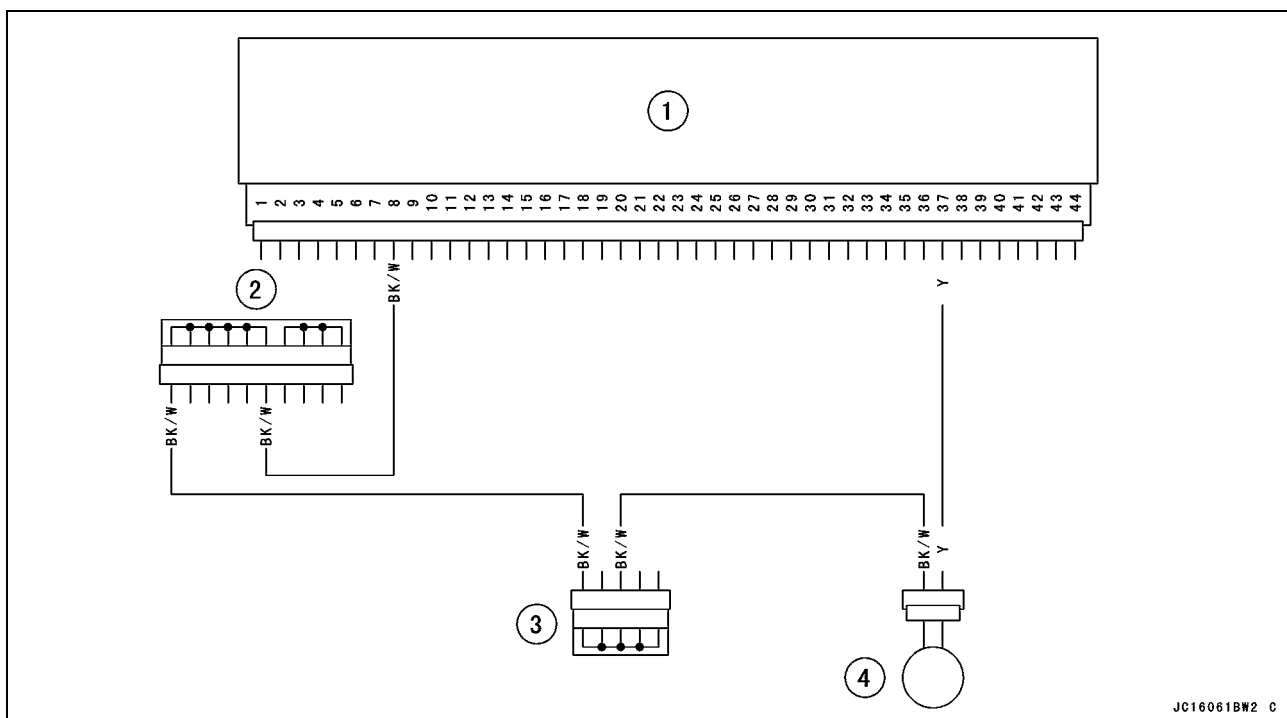
○The output voltage changes according to the oil temperature in the engine.

3-58 FUEL SYSTEM (DFI)

Oil Temperature Sensor (Service Code/Character-73/OILC or 73/OILt)

- Turn the ignition switch OFF.
- ★ If the output voltage is out of the specified, check the ECU for its ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.
- ★ If the output voltage is far out of the specified (e.g. when the wiring is open, the voltage is about 5 V), check the wiring (see next diagram).
- ★ If the wiring is good, check the oil temperature sensor resistance.
- Remove the needle adapter set, and apply silicone sealant to the seals of the connector for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) -Seals of ECU Connectors



1. ECU
2. Joint Connector E
3. Joint Connector J
4. Oil Temperature Sensor

Sensor Resistance Inspection

- Remove the oil temperature sensor (see Oil Temperature Sensor Removal/Installation).
- Refer to Electrical System chapter for oil temperature sensor inspection.

Engine Oil Overheating (Service Code/Character-76/OILH)

JT1500-A2 model ~;

- If the service code is displayed, check the doubtful parts referring to the following table.

Possible causes	Action (Chapter)
Incorrect engine oil level	Inspect (see 4 chapter)
Engine oil poor quality or incorrect	Change (see 4 chapter)
Oil temperature sensor broken	Inspect (see 3 and 14 chapters)
Oil cooler clogged	Clean (see 4 chapter)
Oil pump malfunction	Inspect (see 4 chapter)
Relief valve malfunction	Inspect (see 4 chapter)
Water passage clogged, loosened or damaged	Inspect (see 9 chapter)
Weeds or debris in jet pump	Inspect (see 11 chapter)

3-60 FUEL SYSTEM (DFI)

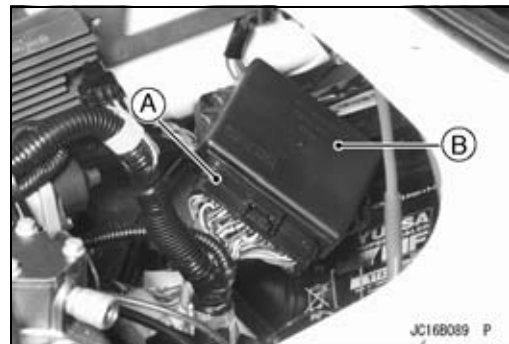
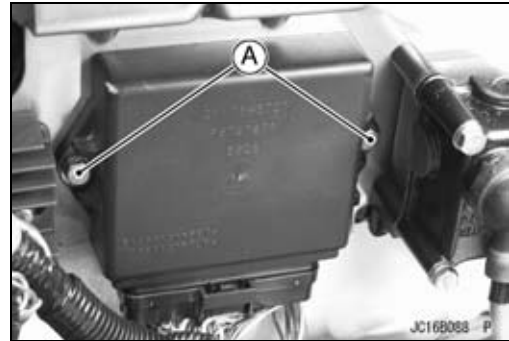
ECU

CAUTION

Never drop the ECU, especially on a hard surface. Such a shock to the ECU can damage it.

ECU Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Bolts [A]
- Disconnect the ECU lead connector [A].
- Remove:
 - ECU [B]



ECU Installation

- Connect the ECU connector and install it.
- Apply a non-permanent locking agent to the bolts and tighten them.

Torque - ECU Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78in·lb)

ECU Power Supply Inspection

- Visually inspect the terminals [A] of the ECU connectors.
- ★ If the connector is clogged with mud or dust, blow it off with compressed air.
- ★ Replace the main harness if the terminals of the main harness connector is cracked, bent, or otherwise damaged.
- ★ Replace the ECU if the terminals of the ECU connector is cracked, bent, or otherwise damaged.



- With the ECU connector [A] connected, check the following ground lead for continuity with the ignition switch OFF, using a tester and needle adapter set.

[B] Battery
[C] Tester

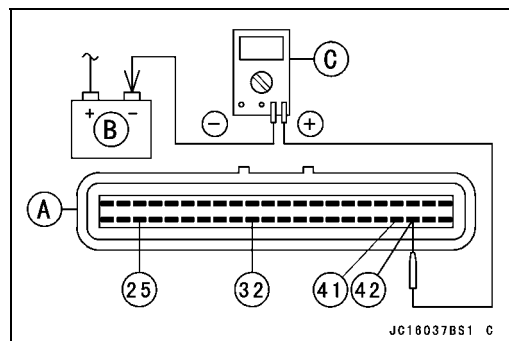
Special Tool - Needle Adapter Set: 57001-1457

ECU Grounding Inspection

25, 32, 41, or 42 (BK) ↔ Battery (-) Terminal: 0 Ω Terminal

Engine Ground ↔ Battery (-) Terminal: 0 Ω

- ★ If no continuity, check the connector, the engine ground lead, or main harness, and repair or replace them if necessary.



ECU

- Check the ECU power source voltage with a tester [A].
- Position the terminal in accordance with terminal numbers of ECU connector [B] in this chapter figure.

ECU Power Source Inspection

Tester Connections:

- 2 (R/G) Terminal – Battery (-) Terminal
- 9 (R/W) Terminal – Battery (-) Terminal
- 28 (Y/R) Terminal – Battery (-) Terminal
- 30 (R/Y) Terminal – Battery (-) Terminal

Terminal Voltage:

Ignition Switch OFF:

- 2 (R/G) Terminal → Battery Voltage
- 9 (R/W) Terminal → 0 V
- 28 (Y/R) Terminal → 0 V
- 30 (R/Y) Terminal → 0 V

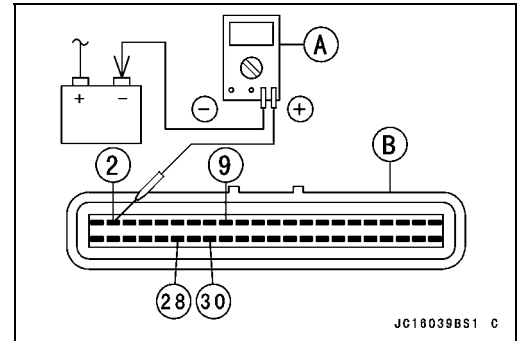
Ignition Switch ON:

- 2 (R/G) Terminal → Battery Voltage
- 9 (R/W) Terminal → Battery Voltage
- 28 (Y/R) Terminal → 0 V
- 30 (R/Y) Terminal → 0 V

Ignition Switch ON and Start Button ON:

- All Terminals → Battery Voltage

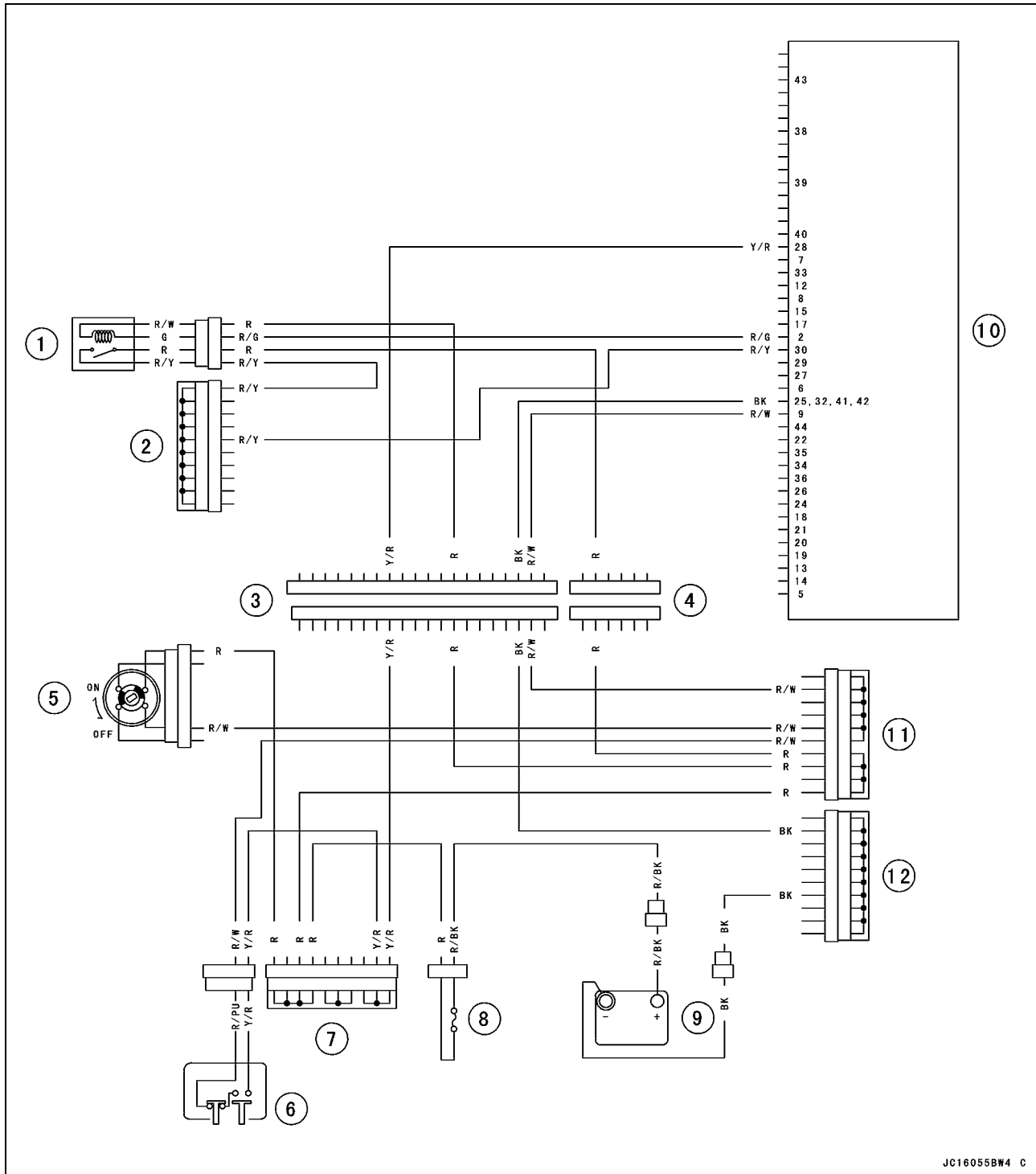
- Pushing the start button, run the engine 3 ~ 4 seconds.
- Wait 15 seconds before using the starter again.
- ★ If the tester does not read as specified, check the following:
 - Power Source Wiring (see wiring diagram below)
 - Main Fuse 20 A (see Electrical System chapter)
 - ECU Main Relay (see DFI Power Source section)
 - Ignition Switch (see Electrical System chapter)
 - Start Switch (see Electrical System chapter)



3-62 FUEL SYSTEM (DFI)

ECU

ECU Power Source Circuit



JC16055BW4 C

1. Main Relay in Relay assembly
2. Joint Connector F
3. Connector C
4. Connector D
5. Ignition Switch
6. Start Switch
7. Joint Connector R
8. Main Fuse 20 A
9. Battery
10. ECU
11. Joint Connector P
12. Joint Connector S

DFI Power Source

Main Fuse Inspection

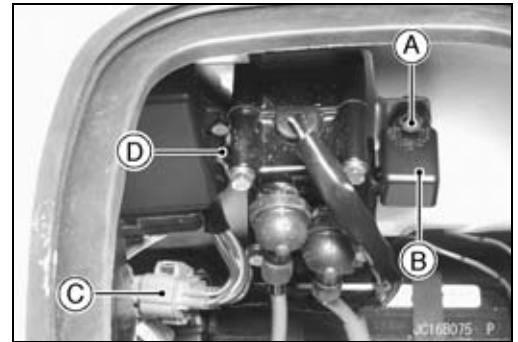
- Refer to the Electrical System chapter for the ECU Fuse Inspection.

Relay Assembly Removal

CAUTION

Never drop the relay, especially on a hard surface. Such a shock to the relay can damage it.

- Remove:
 - Seats (see Frame chapter)
 - Bolt [A]
 - Relay Assembly [B]
 - Connector [C] (disconnect)
 - Band [D] (Cut)



Relay Assembly Inspection

- Remove the relay assembly.
- Connect the hand tester [A] and one 12 V battery [B] to the relay connector [C] as shown.

Special Tool - Hand Tester: 57001-1394

Main Relay

- Relay Coil Terminals [3] and [4]
- Relay Switch Terminals [1] and [2]

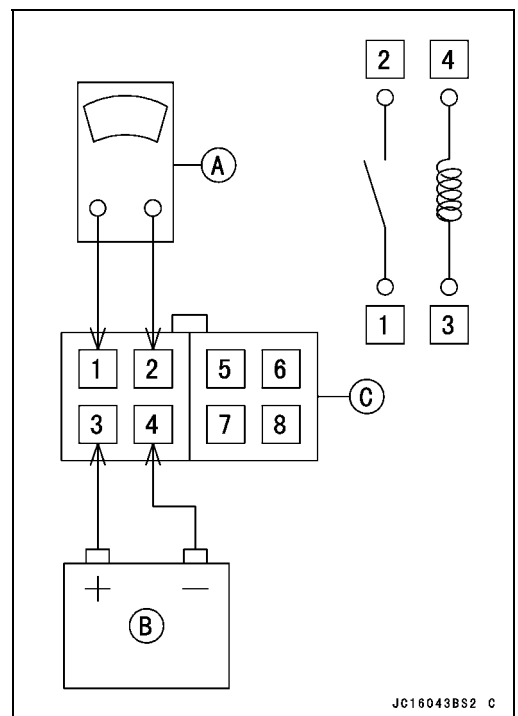
Testing Relay

Tester range: 1 Ω range

Criteria: When battery is connected → 0 Ω

When battery is disconnected → ∞ Ω

- ★ If the relay does not work as specified, replace the relay assembly.



3-64 FUEL SYSTEM (DFI)

DFI Power Source

Fuel Pump Relay

Relay Coil Terminals [6] and [8]

Relay Switch Terminals [5] and [7]

Testing Relay

Tester range: 1 Ω range

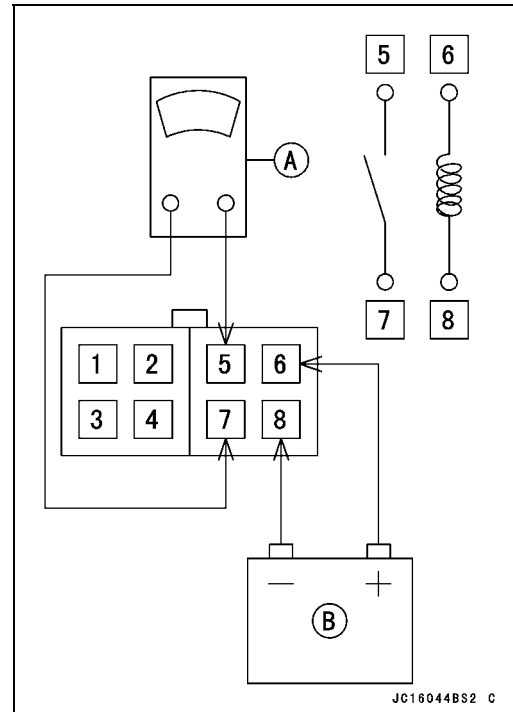
Criteria: When battery is connected \rightarrow 0 Ω

When battery is disconnected \rightarrow ∞ Ω

★If the relay does not work as specified, replace the relay assembly.

Hand Tester [A]

Battery [B]



Throttle Lever, Cable and Case

Free Play Inspection

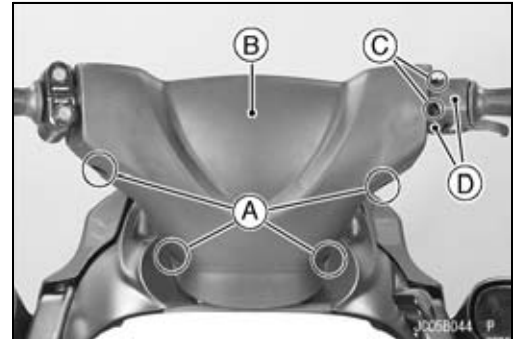
- Refer to Throttle Control System Inspection in the Periodic Maintenance chapter.

Throttle Cable Adjustment

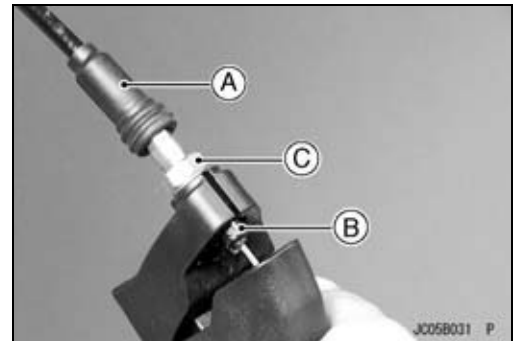
- Refer to Throttle Cable Adjustment in the Periodic Maintenance chapter.

Throttle Case Removal/Disassembly

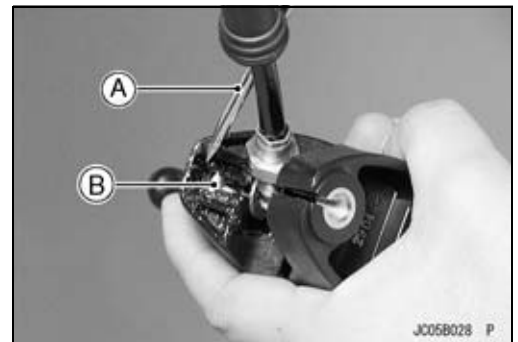
- Unscrew the mounting screws [A] and remove the handlebar pad [B].
- Remove the throttle case.
- Unscrew the throttle case mounting screws [C] separate the case halves [D].



- Disconnect the throttle cable from the case.
- Slide the rubber boots [A] and rubber cap [B] out of the place.
- Unscrew the throttle cable fitting nut [C].



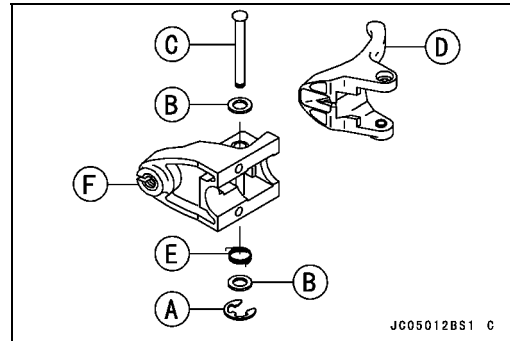
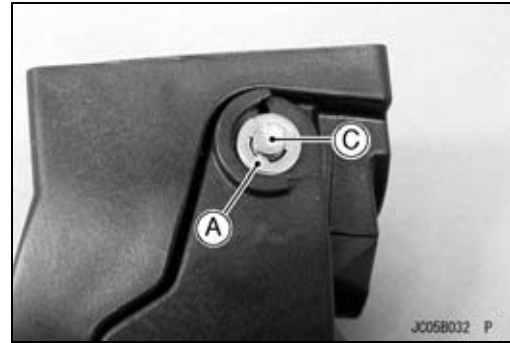
- Use a screw driver [A] to separate the tip [B] of the cable end from the case body.



3-66 FUEL SYSTEM (DFI)

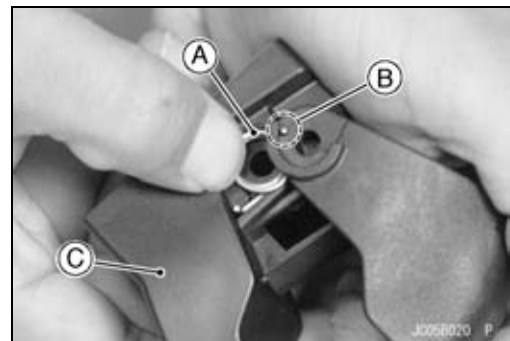
Throttle Lever, Cable and Case

- Disassemble the throttle case.
- Remove the circlip [A], flat washers [B], pin [C], throttle lever [D] and return spring [E] from the case [F].

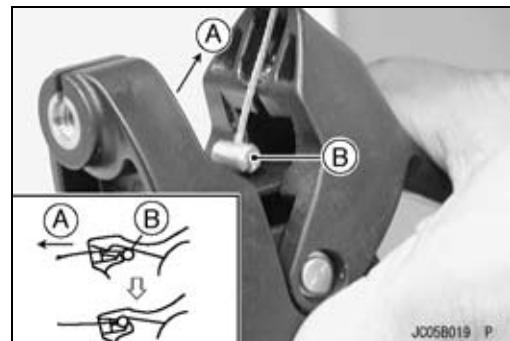


Throttle Case Assembly/Installation

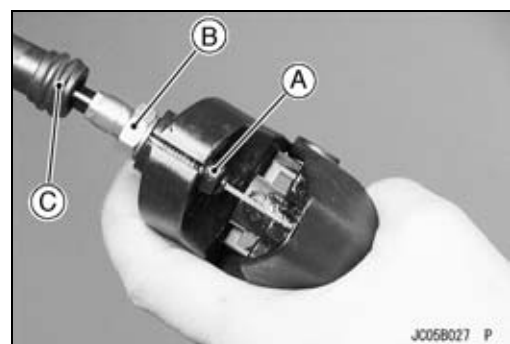
- Insert the end of the return spring [A] in the throttle lever hole [B] and set the spring in the throttle case [C] as shown.
- Install the control lever to the case.



- Lubricate the throttle cable before assembly/installation.
- Apply water resistant grease to the tips of the throttle cable end.
- Pulling the throttle cable [A], position the tips [B] of the cable end as shown.
- Tighten the cable fitting nut.



- Be sure the rubber cap [A] is in place on the throttle cable fitting nut end.
- Cover the cable fitting nut [B] with the rubber boot [C].



Throttle Lever, Cable and Case

- Tighten:
Torque - Throttle Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 34 in·lb)
- Swing the throttle lever so that the throttle valve is fully open.

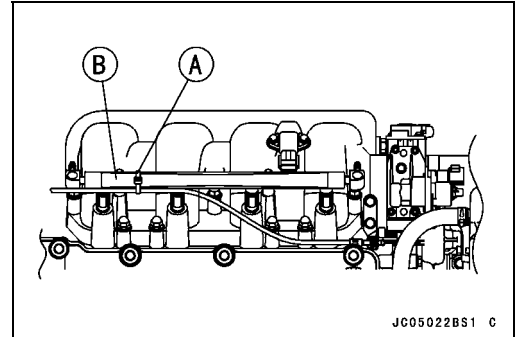
⚠ WARNING

Operation with an improperly assembled throttle case could result in an unsafe riding condition.

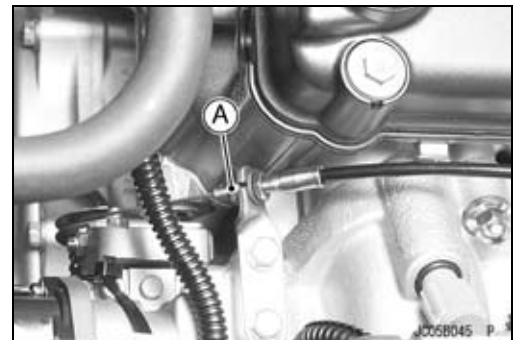
- Adjust the throttle cable (see Throttle Cable Adjustment).

Throttle Cable Removal

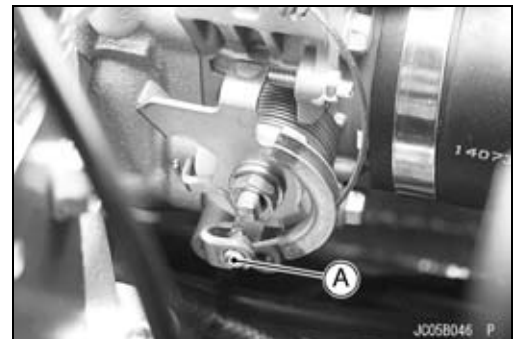
- Remove the engine hood (see Hull/Engine Hood chapter).
- Remove the band [A] on the delivery pipe [B]



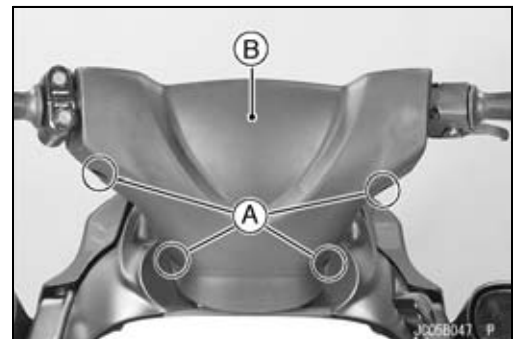
- Disconnect the throttle cable from the body assy.
 - Slide out the rubber cap.
 - Unscrew the adjuster locknut [A] and slide the cable from the bracket.



- Slide the tip [A] of the cable lower end from the throttle pivot arm.



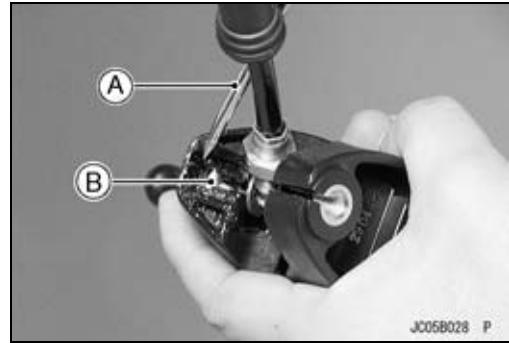
- Unscrew the mounting screws [A] and remove the handlebar pad [B].
- Take out the inner pad



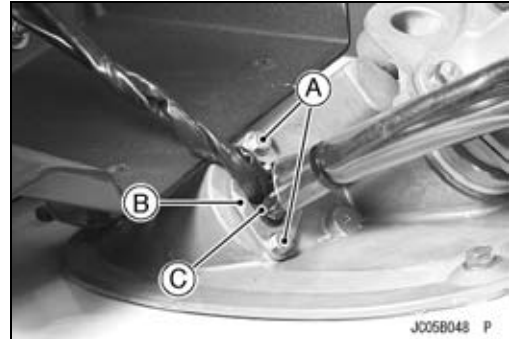
3-68 FUEL SYSTEM (DFI)

Throttle Lever, Cable and Case

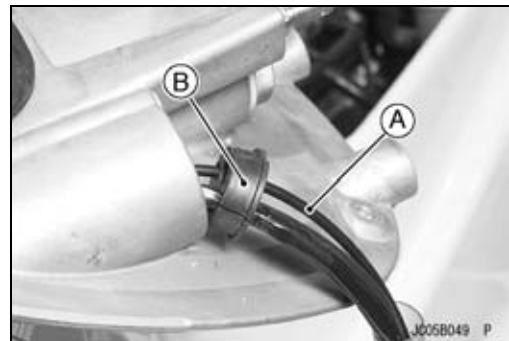
- Remove the throttle case (see Throttle Case Removal).
- Slide the rubber boot out of the place.
- Unscrew the throttle cable fitting nut.
- Remove the upper end of the cable from the case.
- Use a screw driver [A] to separate the cable tip [B] from the throttle lever catch.



- Remove the steering cover (see Steering Removal in Steering chapter).
- Unscrew the grommet mounting bolts [A] and pull out the plate [B] and grommet [C].

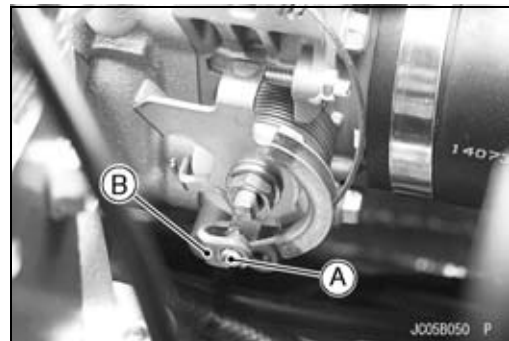


- Take the throttle cable [A] off the grommet [B].
- Pull down the throttle cable.



Throttle Cable Installation

- Lubricate the outside of the new cable with a penetrating rust inhibitor to ease cable installation.
- Slide the tip [A] of the cable lower end on the throttle pivot arm [B].



Throttle Lever, Cable and Case

- Tighten:
 - Torque - Throttle Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 34 in·lb)**
- Route the following correctly (see Cable, Wire, and Hose Routing in Appendix chapter).
 - Throttle Cable
 - Steering Cable
 - Fuel Tank Vent Hose
 - Start/Stop Switch Leads
 - Buzzer Leads
 - Multifunction Meter Leads
- Adjust the following.
 - Throttle Cable
- Check that the throttle lever moves smoothly from full open to close, and the throttle closes quickly and completely in all steering positions by return spring.
- ★ If the throttle lever does not return properly, check the throttle routing, cable adjustments, and cable damage. Then lubricate the throttle cable.
- Run the engine at the idle speed, and turn the handlebar all the way to the right and left to ensure that the idle speed does not change.
- ★ If the idle speed increases, check the throttle cable adjustment and the cable routing.

Throttle Case and Cable Lubrication

- Refer to the Lubrication in the Periodic Maintenance chapter.

Throttle Cable Inspection

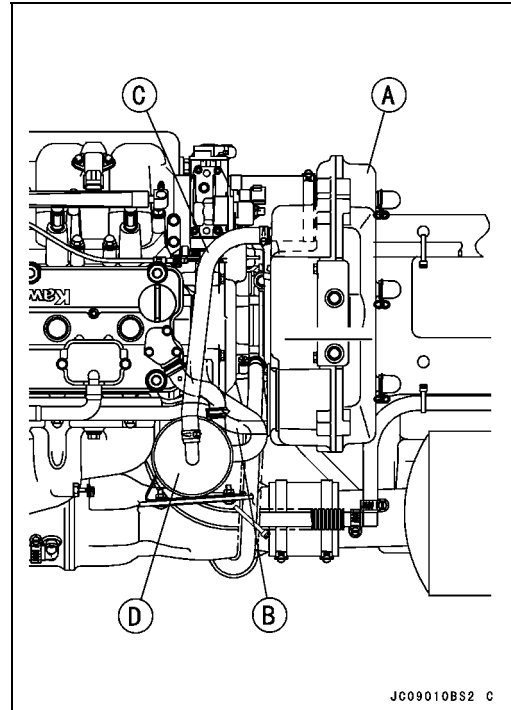
- Refer to the Lubrication in the Periodic Maintenance chapter.

3-70 FUEL SYSTEM (DFI)

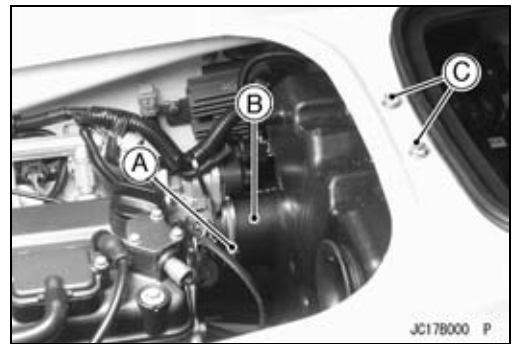
Air Filter

Air Filter Removal

- Remove the seat (see Hull/Engine Hood chapter).
- Remove the rear storage pocket.
- Disconnect the following from the air filter [A].
 - Air Suction Valve Hose [B]
 - Oil Separator Tank Hose [C]
- Remove the oil separator tank [D] (see Engine Lubrication System chapter).



- Loosen the clamp [A] on the inlet air duct [B].
- Remove the air filter mounting bolts [C].



- Remove the air filter [A] out of the engine compartment.



Air Filter Installation

- Tighten:
 - Torque - Air Filter Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

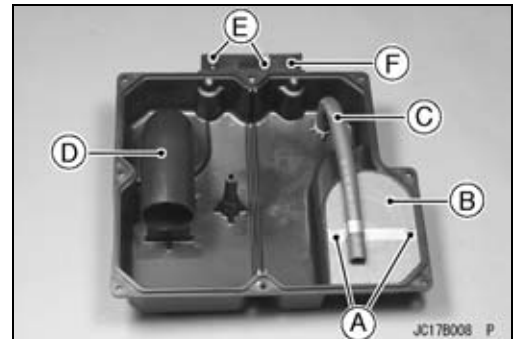
Air Filter

Air Filter Disassembly

- Remove:
 - Air Filter (see Air Filter Removal)
 - Air Filter Bolts [A]



- Remove:
 - Bolts [A]
 - Flame Arrester [B]
 - Hose [C]
 - Duct [D]
 - Air Filter Bracket Mounting Bolts [E]
 - Air Filter Bracket [F]

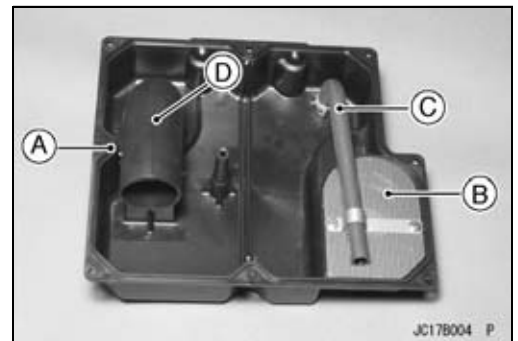


- Remove the air screen [A]

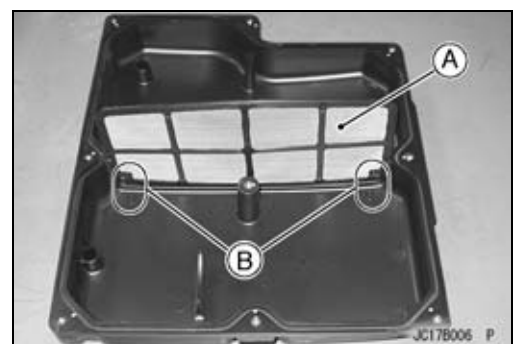


Air Filter Assembly

- Visually inspect the seal [A] for damage.
 - ★ If necessary, replace it with a new one.
- Install the flame arrester [B], hose [C] and duct [D] as shown.



- Install the air screen [A] aligning the marks [B].



- Apply a non-permanent locking agent to the air filter bracket mounting bolts and tighten them.

Torque - Air Filter Bracket Mounting Bolts: 7.8 N m (0.80 kgf-m, 69 in-lb)

3-72 FUEL SYSTEM (DFI)

Throttle Body Assy

Idle Speed Inspection

The normal idle speed is controlled by the ECU (Electronic Control Unit).

Idle Speed

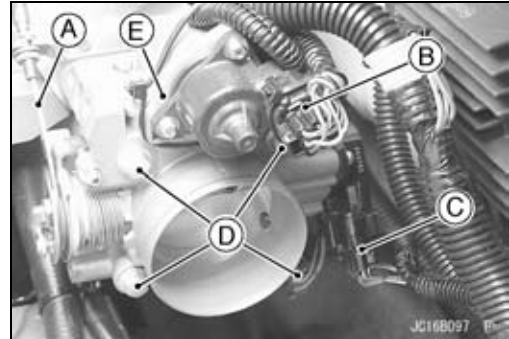
Standard: 1 300 ±100 r/min (rpm) -both in and out of water

High Altitude Performance Adjustment

High altitude adjustment is not required as the ECU controls the air/fuel mixture automatically.

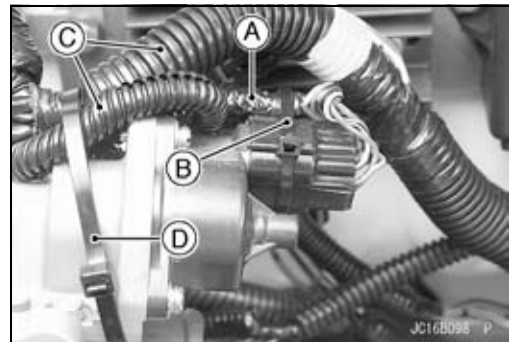
Throttle Body Assy Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Air Filter (from Throttle Body Assy)
 - Throttle Cable [A] (see Throttle Cable Removal)
 - Air Inlet Duct
 - ISC (Idle Speed Controller) Connector [B]
 - Throttle Sensor Connector [C]
 - Throttle Body Assy Mounting Bolts [D]
 - Throttle Body Assy [E]
 - Gasket



Throttle Body Assy Installation

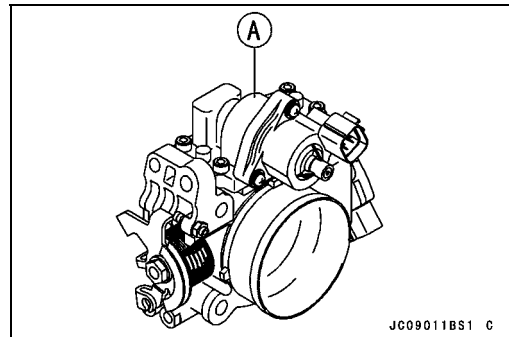
- Install a new gasket.
- Tighten:
 - Torque - Throttle Body Assy Mounting Bolts: 20 N·m (2.0 kgf·m, 14 ft·lb)**
- Install the throttle cable and adjust the free play.
- Bind the harness [A] and connector in the band [B].
- Route the harness [C] and tighten the band [D] correctly (see Appendix chapter).



Throttle Body Assy Disassembly

CAUTION

Do not disassemble or adjust, the air screw, throttle link mechanism and throttle body assy [A], because they are adjusted or set surely at the manufacturer. Adjustment of these parts could result in poor performance, requiring replacement of the throttle body assy.

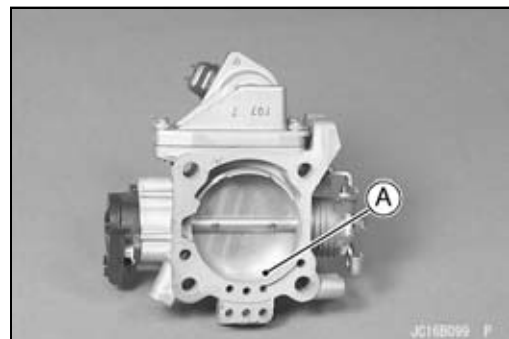


Throttle Bore Cleaning

- Remove the throttle body assy (see Throttle Body Assy Removal).
- Check the throttle bore [A] for carbon deposits by opening the valve.
- ★ If any carbon accumulates, wipe the carbon off the throttle bore and throttle valve, using a cotton pad.

CAUTION

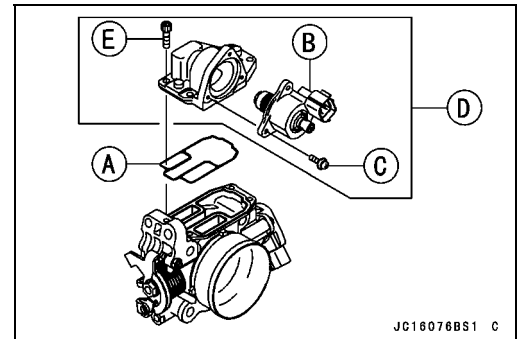
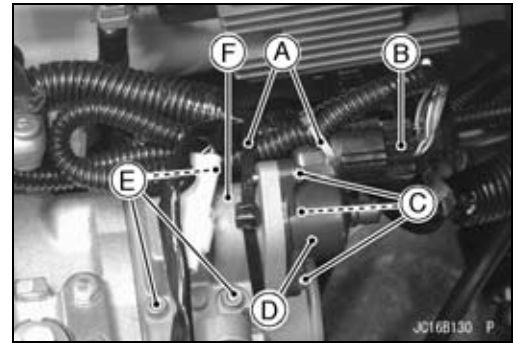
Do not rub these surfaces hard and do not use a carburetor cleaning solution.



Throttle Body Assy

ISC (Idle Speed Controller) Removal/Installation

- Remove
 - Seat (see Hull/Engine Hood chapter)
 - Air Filter (see Air Filter Removal)
 - Bands [A]
 - ISC connector [B]
 - Stepping Motor Mounting Screws [C]
 - Stepping Motor [D]
 - ISC Actuator Mounting Bolts [E]
 - ISC Actuator [F]
 - Clean the mating surface of throttle body and ISC actuator (stepping motor).
 - Replace the O-ring [A] with a new one.
 - Install the stepping motor [B] and tighten the screws [C].
 - Install the ISC actuator [D] and tighten the bolts [E].
- Torque - ISC Actuator Mounting Bolts: 4.9 N·m (0.50 kgf·m, 43 in·lb)**
- Route the harness and tighten the bands correctly (see Appendix chapter).
 - After installing the ISC actuator, check the Smart Steering System Operation in the water.



ISC (Idle Speed Controller) Inspection

- Check idle speed with a tachometer in the multifunction meter.
- With the engine idling, open and close the throttle lever.

Idle Speed

Standard: 1 300 ±100 r/min (rpm) -both in and out of water

- ★ If the idle speed is within the standard, the ISC operates properly.
- ★ If the idle speed is out of the specified range, inspect the audible operation.
- Run the engine and then stop the engine.
- Certain buzzing and humming sounds will be emitted from the ISC [A] after the engine stop.
- ★ If the ISC sounds, inspect the ISC resistance.
- ★ If the ISC does not sound, replace the stepping motor.



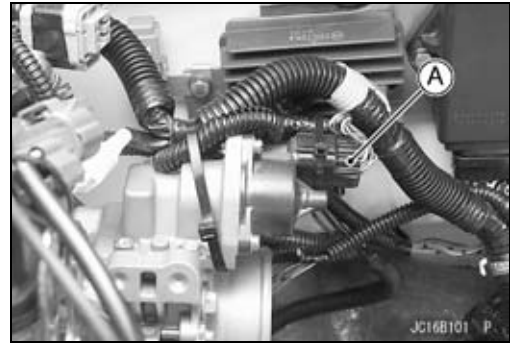
3-74 FUEL SYSTEM (DFI)

Throttle Body Assy

ISC Resistance Inspection

- Remove:

- Air Filter (from the throttle body assy)
- ISC Connector [A] (disconnect)



- Measure the ISC resistance with the hand tester.

Special Tool - Kawasaki Hand Tester: 57001-1394

- ISC [A]
- Rotor [B]

ISC Resistance

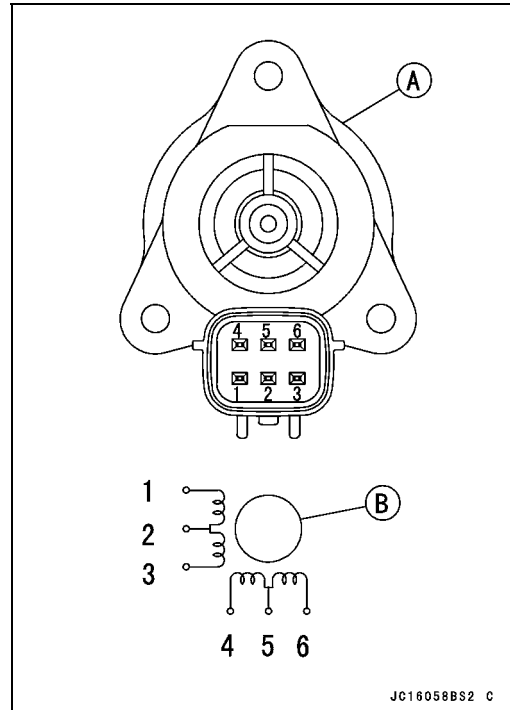
Connection: 1-2, 2-3, 4-5, 5-6 terminals

Standard: about 30 Ω (at 20°C)

Connection: 1-3, 4-6 terminals

Standard: about 60 Ω (at 20°C)

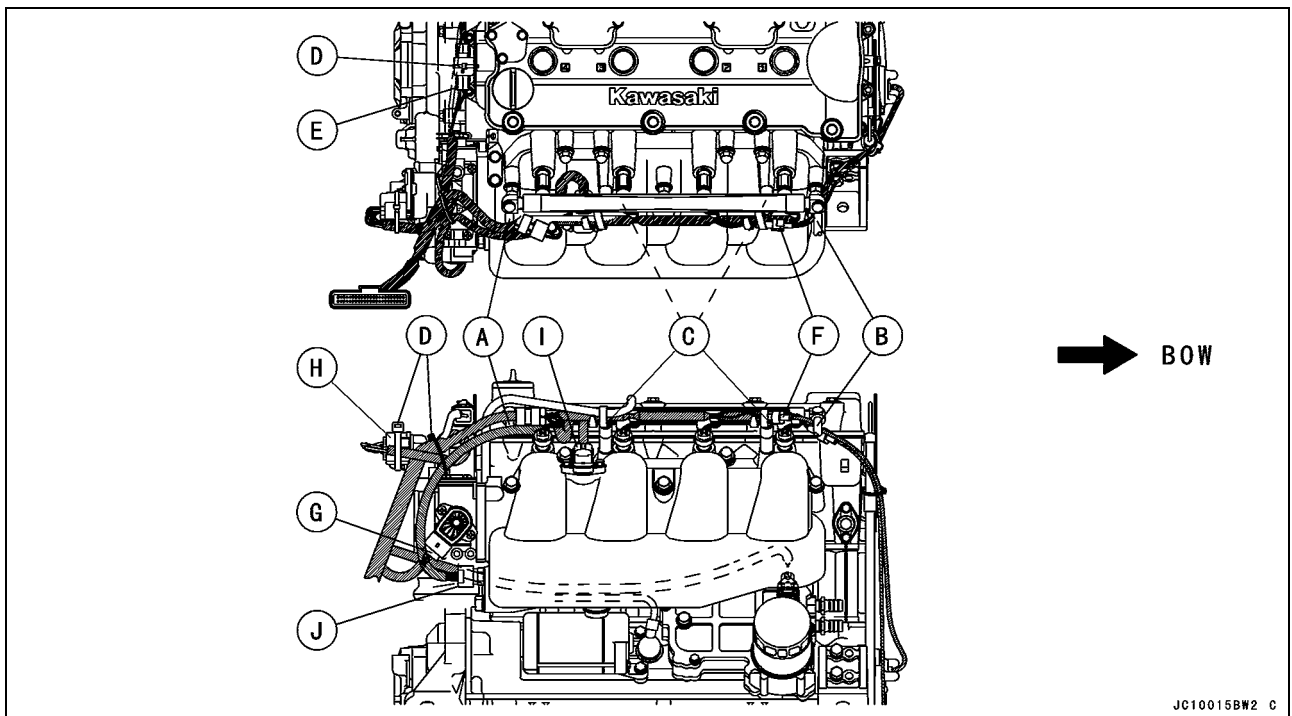
- ★ If the reading is out of the specified value, replace the stepping motor.



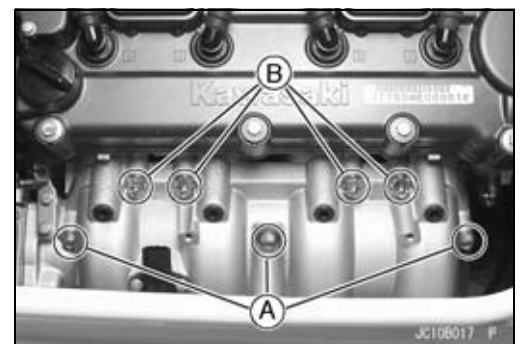
Inlet Manifold

Inlet Manifold Removal

- Remove:
 - Supply Fuel Hose [A] at Delivery Pipe
 - Return Fuel Hose [B] at Delivery Pipe
 - Delivery Pipe Mounting Bolts [C], Collars and Clamps
- Remove the bands [D] and disconnect the following connectors.
 - Camshaft Position Sensor Connector [E]
 - Crankshaft Sensor Connector [F]
- Disconnect:
 - Throttle Cable Lower End (see Throttle Cable Removal)
 - Throttle Sensor Connector [G] on Throttle Body Assy
 - ISC (Idle Speed Controller) Connector [H] on Throttle Body Assy
 - Inlet Air Pressure Sensor Connector [I] on Inlet Manifold
 - Inlet Air Temperature Sensor Connector [J] on Inlet Manifold



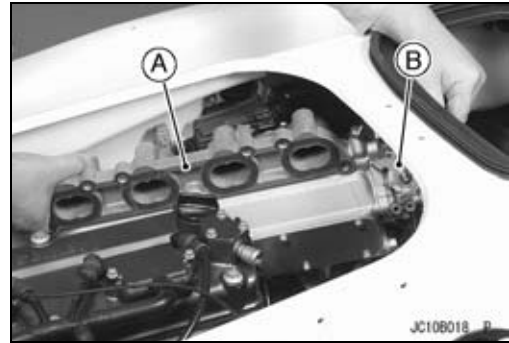
- Unscrew the inlet manifold mounting bolts [A] and nuts [B].



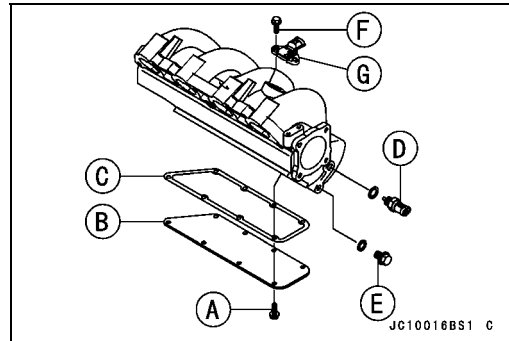
3-76 FUEL SYSTEM (DFI)

Inlet Manifold

- Remove the inlet manifold [A] with the throttle body assy [B].
- Remove the throttle body assy from the inlet manifold (see Throttle Body Assy Removal).



- Unscrew the inlet manifold plate bolts [A] and remove the plate [B] and gasket [C].
- Remove:
 - Inlet Air Temperature Sensor [D]
 - Inlet Manifold Drain Plug [E]
 - Inlet Air Pressure Sensor Bolts [F]
 - Inlet Air Pressure Sensor [G]



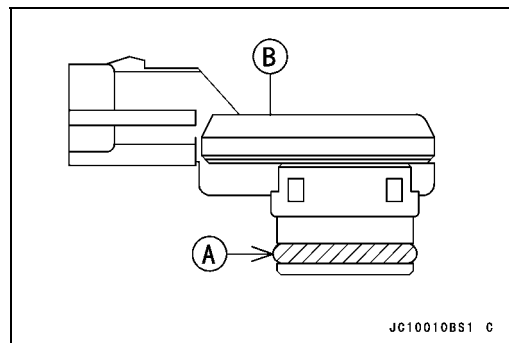
Inlet Manifold Installation

- Replace the inlet manifold plate gasket with a new one.
- Tighten:
 - **Torque - Inlet Manifold Plate Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)**
 - **Inlet Manifold Drain Plug: 20 N·m (2.0 kgf·m, 14 ft·lb)**
 - **Inlet Air Temperature Sensor: 20 N·m (2.0 kgf·m, 14 ft·lb)**
- Apply silicone oil to the O-ring [A] on the inlet air pressure sensor [B].

NOTE

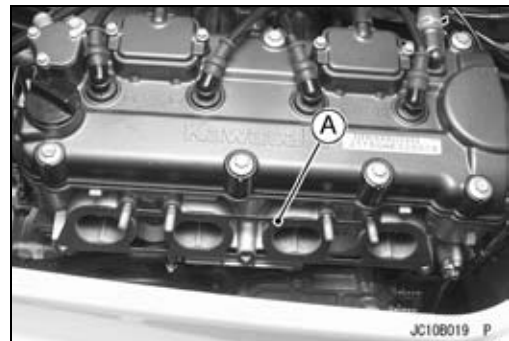
○Do not apply silicone oil to the inside of inlet air pressure sensor connector.

- Install the inlet air pressure sensor on the inlet manifold.
 - **Torque - Inlet Air Pressure Sensor Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)**



- Replace the inlet manifold gasket [A] with a new one and install it as shown.
- Apply a non-permanent locking agent to the inlet manifold mounting bolts and tighten them.

- **Torque - Inlet Manifold Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**
- **Inlet Manifold Mounting Nuts: 20 N·m (2.0 kgf·m, 14 ft·lb)**

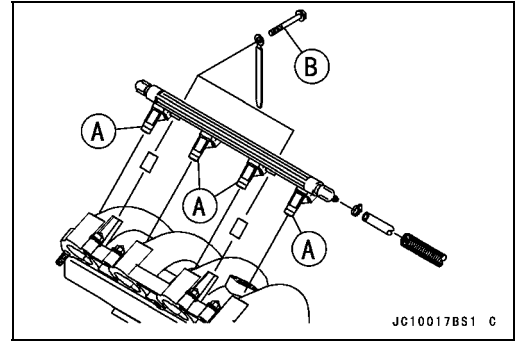


Inlet Manifold

- Replace the injector seals [A] with new ones.
- Apply grease to the inside and outside of seals.
- Tighten the delivery pipe mounting bolts [B].

Torque - Delivery Pipe Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Route the cable, wire and hose correctly (see Cable, Wire and Hose Routing in Appendix chapter).
- For JT1500-A2 model ~; Replace the double spring clamps with new ones. (see Fuel System Diagram)



3-78 FUEL SYSTEM (DFI)

Fuel Line

Fuel Pressure Inspection

NOTE

○Be sure the battery is fully charged.

- Be sure to place a piece of cloth under the fuel supply hose [A] of the fuel delivery pipe.

⚠ WARNING

Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately. When the fuel hose is disconnected, fuel spills out from the hose and the pipe because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.

- Loosen the clamp bolt [B] and pull out the fuel supply hose.
- For JT1500-A2 model ~; Loosen the double spring clamp [B] with pliers and pull out the fuel supply hose.
- Quickly install the fuel pressure gauge adapter [A] between the fuel supply pipe and the fuel supply hose.
- Connect the pressure gauge [B] to the fuel pressure gauge adapter.

**Special Tools - Fuel Pressure Gauge Adapter: 57001-1463
Oil Pressure Gauge, 5 kgf/cm²: 57001-125**

⚠ WARNING

Do not try to start the engine with the fuel hoses disconnected.

- Start the engine, and let it idle.
- Measure the fuel pressure with the engine idling.

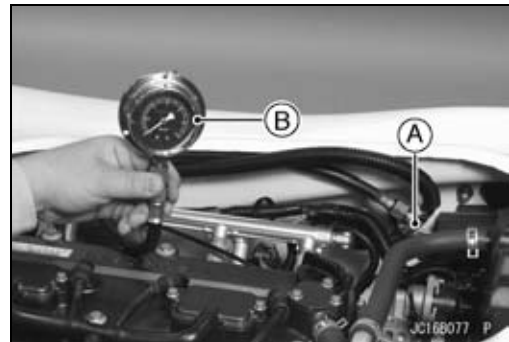
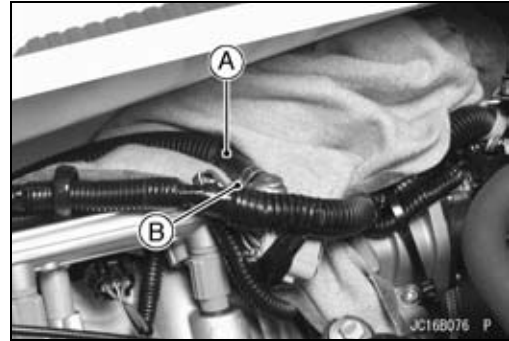
Fuel Pressure (idling)

Standard: approx. 294 kPa (3.0 kgf/cm², 43 psi)

NOTE

○The gauge needle will fluctuate. Read the pressure at the average of the maximum and minimum indications.

- ★ If the fuel pressure is much higher than the specified, check the following:
 - Fuel Hose from Gauge Adapter to Fuel Pump Return Pipe for Sharp Bend, Kinking, or Clogging
 - Fuel Pump
- ★ If the fuel pressure is much lower than specified, check the following:
 - Fuel Line Leakage
 - Fuel Injectors
 - Fuel Pump
 - Amount of Fuel Flow (see Fuel Flow Rate Inspection)



Fuel Line

- ★ If the fuel pressure is much lower than specified, and if inspection above checks out good, replace the fuel filter and measure the fuel pressure again.
- Remove the fuel pressure gauge and adapter.
- Run the fuel hoses in accordance with the Cable, Wire, and Hose Routing section in the Appendix chapter.
- For JT1500-A2 model ~; Replace the double spring clamps with new ones. (see Fuel System Diagram)

Fuel Flow Rate Inspection

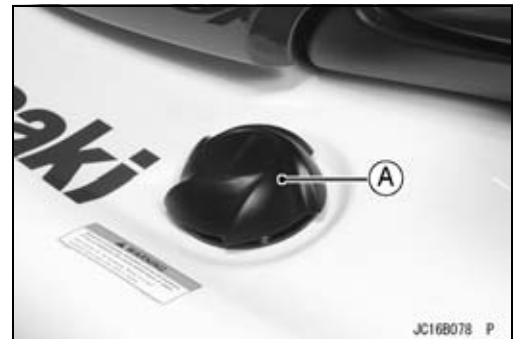
NOTE

- Be sure the battery is fully charged.

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke. Turn the ignition switch OFF. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

- Turn the ignition switch OFF.
- Wait until the engine cools down.
- Open the fuel tank cap [A] to lower the pressure in the tank.



3-80 FUEL SYSTEM (DFI)

Fuel Line

- Prepare a measuring cylinder [A].
- Disconnect the fuel supply hose from the fuel delivery pipe, and set the measuring cylinder and fuel supply hose [B] as shown.
- Close the fuel tank cap.

⚠ WARNING

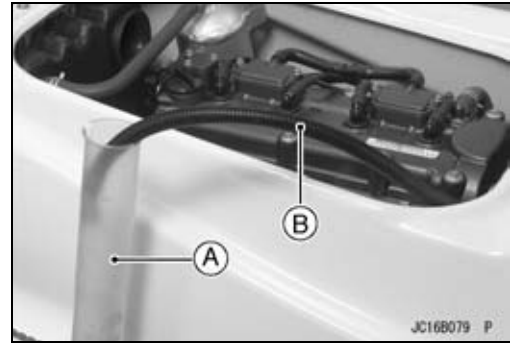
**Wipe off spilled out fuel immediately.
Be sure to hold the measuring cylinder vertical.**

- Turn the ignition switch ON.
- Push the start button for 3 seconds.
- Measure the discharge for 3 seconds.

Amount of Fuel Flow

Standard: 67 mL or more for 3 seconds

- ★ If the fuel flow is much less than the specified, check the following:
 - Fuel Hose from Fuel Pump Supply Pipe to Fuel Filter for Sharp Bend, Kinking, or Clogging
 - Fuel Pump Operation (see Fuel Pump Operation Inspection)
 - Fuel Pump Screen (see Fuel Pump Screen Cleaning)
- ★ If above inspection checks out good, replace the fuel pump, and measure the amount of fuel flow again.
- After inspection, connect the fuel hose.
- Start the engine and check for fuel leakage.
- For JT1500-A2 model ~; Replace the double spring clamps with new ones. (see Fuel System Diagram)



Fuel Vent Check Valve

Fuel Vent Check Valve Mounting

- Refer to Fuel Vent Check Valve Inspection in the Periodic Maintenance chapter.

Fuel Vent Check Valve Inspection

- Refer to Fuel Vent Check Valve Inspection in the Periodic Maintenance chapter.

3-82 FUEL SYSTEM (DFI)

Fuel Filter

Fuel Filter Removal

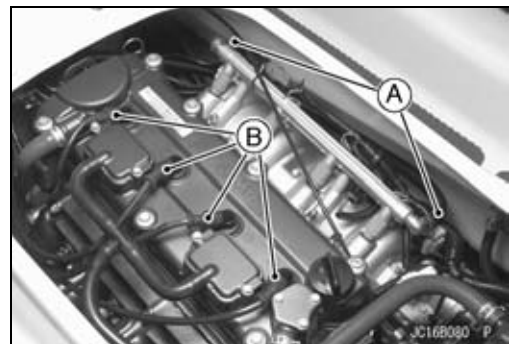
NOTE

○The fuel filter is designed to be used throughout the watercraft's life without any maintenance if it is used under normal conditions.

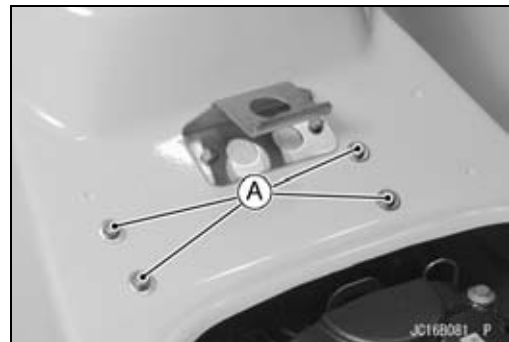
⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke.

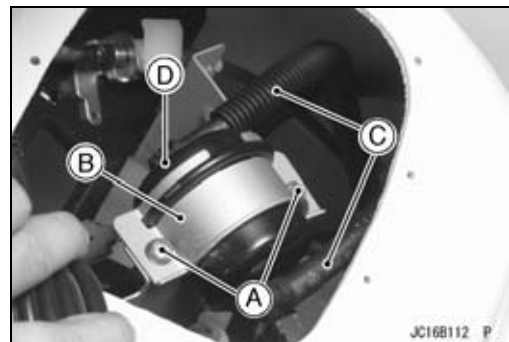
- Remove:
 - Front Storage Pocket (see Hull/Engine Hood chapter)
 - Fuel Hoses [A]
- Disconnect:
 - Spark Plug Caps [B]
 - Vehicle-down Sensor Lead Connector
 - Ignition Coil Primary Lead Connectors



- Remove:
 - Bracket Mounting Bolts [A]



- Remove:
 - Fuel Filter Mounting Bolts [A]
 - Holder [B]
 - Fuel Hoses [C]
 - Fuel Filter [D]

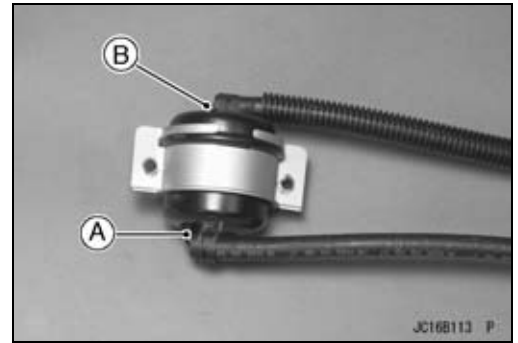


Fuel Filter

Fuel Filter Installation

- Route the hose correctly (see Cable, Wire, and Hose Routing section in Appendix chapter).
 - Install the fuel hoses to the fuel filter, noting its “IN” fitting [A] and “OUT” fitting [B].
- For JT1500-A2 model ~; Replace the double spring clamps with new ones. (see Fuel System Diagram)
- Install the holder and apply a non-permanent locking agent to the mounting bolts and tighten them.

Torque - Fuel Filter Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)



3-84 FUEL SYSTEM (DFI)

Fuel Pump

Fuel Pump Removal

CAUTION

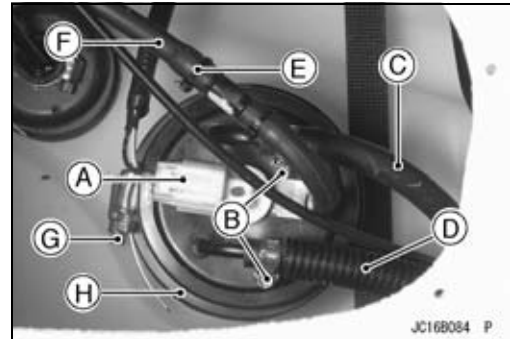
Never drop the fuel pump, especially on a hard surface. Such a shock to the pump can damage it.

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke.

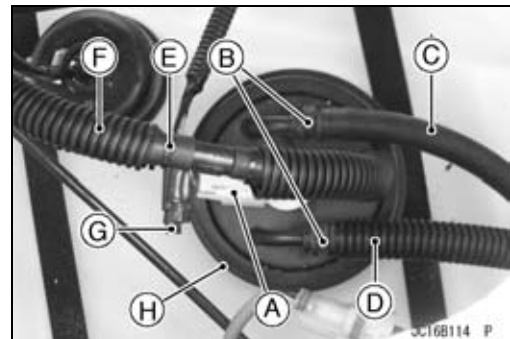
JT1500-A1 model;

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect the fuel pump lead connector [A].
- Loosen the clamp screws [B] and pull out the main [C] and return [D] fuel hoses.
- Cut off the clamp [E] and pull out the fuel vent hose [F].
- Loosen the lower side clamp screw [G] on the rubber fuel pump holder [H].

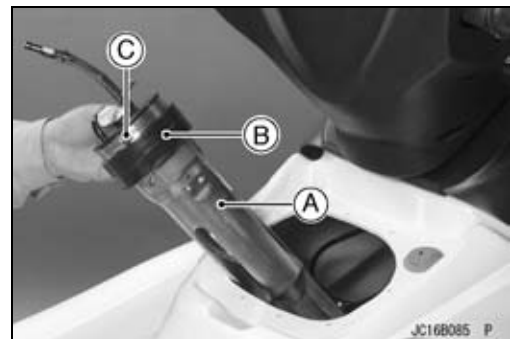


JT1500-A2 ~ model;

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect the fuel pump lead connector [A].
- Loosen the double spring clamps [B] with pliers and pull out the main [C] and return [D] fuel hoses.
- Cut off the clamp [E] and pull out the fuel vent hose [F].
- Loosen the lower side clamp screw [G] on the rubber fuel pump holder [H].



- Pull the fuel pump [A] and rubber holder [B] through the opening gained after removal of the front storage pocket.
- Loosen the upper side clamp screw [C] and remove the rubber holder from the fuel pump.



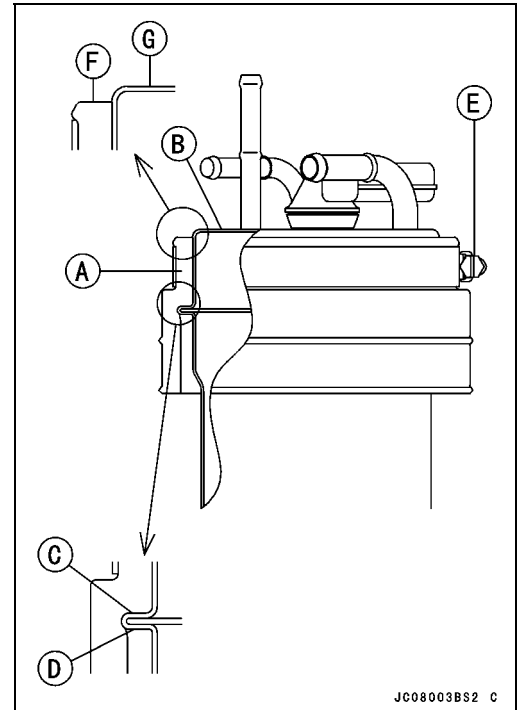
Fuel Pump

Fuel Pump Installation

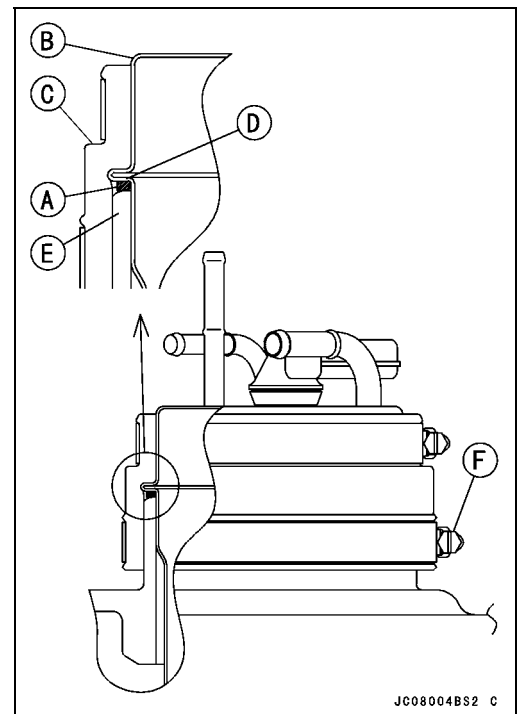
- Press down the rubber holder [A] onto the fuel pump [B] so the stepped part [C] of the holder completely contacts the flanged part [D] of the pump.
- Pressing down the rubber holder onto the fuel pump, tighten the small diameter clamp [E].

NOTE

○ Install the rubber holder onto the fuel pump so the rubber holder top surface [F] must be below the top surface [G] of the fuel pump to prevent any water from collecting on top of the pump.



- Install the O-ring [A] to the space between fuel pump [B] and rubber holder [C] so it completely contacts the flanged part [D] of the pump.
- Insert the fuel pump with rubber holder and O-ring into the tank so its fuel hose fittings face starboard side (see Cable, Wire, and Hose Routing in Appendix chapter). And press down the pump so the O-ring [A] completely contacts the top surface of the tank [E].
- Tighten the large diameter clamp [F] securely.



- Install the following to the fuel pump.
 - Fuel Hoses
 - Fuel Tank Vent Hose
 - Fuel Pump Lead Connector
- For JT1500-A2 model; Replace the double spring clamps with new ones. (see Fuel System Diagram)

NOTE

○ The main fuel hose is larger than the return fuel hose.

Power Source Voltage Inspection

NOTE

○ Be sure the battery is fully charged.

3-86 FUEL SYSTEM (DFI)

Fuel Pump

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Connect the hand tester (25 V DC) [A] to the fuel pump lead connector [B], using the needle adapter set [C].

Special Tools - Hand Tester: 57001-1394

Needle Adapter Set: 57001-1457

- Turn the ignition switch ON and push the lanyard key under the stop button.
 - Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the power source voltage.
- Wait 15 seconds before using the starter again.

Pump Power Source Voltage

Connections

Tester (+) → W/R lead [D]

Tester (-) → Battery (-) Terminal [E]

Power Source Voltage at Pump Lead Connector

Standard: Battery Voltage

- ★ If the reading is good, the power source voltage is normal. Inspect the operating voltage.
- ★ If there is no battery voltage, check the following:
 - Main Fuse 20 A
 - Wiring for Fuel Pump Power Source (see Fuel Pump Circuit in this chapter)

Operating Voltage Inspection

NOTE

○ Be sure the battery is fully charged.

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Connect the hand tester [A] to the connector [B], using the needle adapter set [C].

Special Tools - Hand Tester: 57001-1394

Needle Adapter Set: 57001-1457

- Turn the ignition switch ON and push the lanyard key under the stop button.
 - Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the operating voltage.
- Wait 15 seconds before using the starter again.

Pump Operating Voltage

Connections

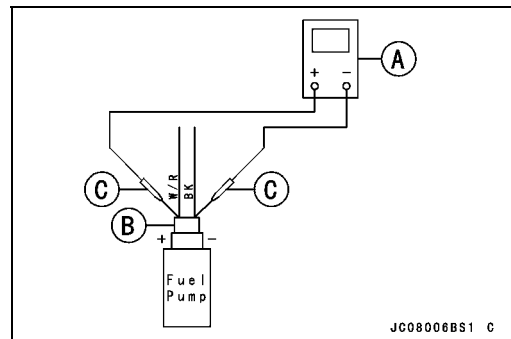
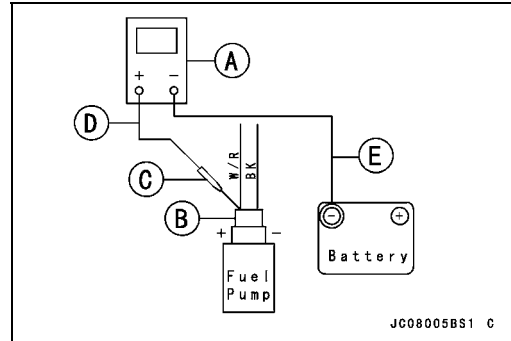
Tester (+) → W/R lead

Tester (-) → BK lead

Operating Voltage

Standard: Battery Voltage

- ★ If the reading stays on battery voltage but the pump doesn't work, replace the pump.
- ★ If there is no battery voltage at all, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, check the fuel pump wiring.



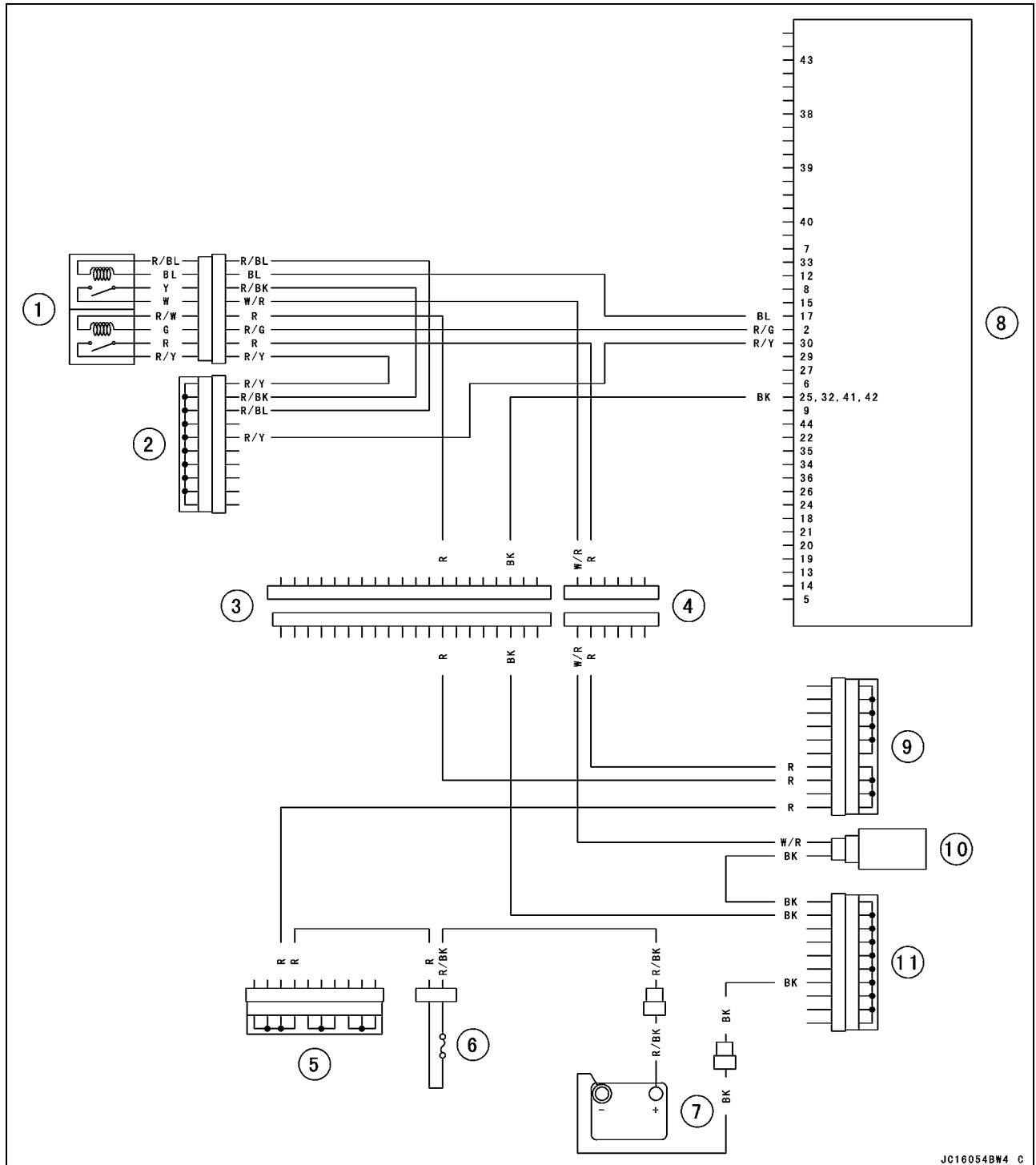
Fuel Pump

Fuel Pump Relay Removal

- Refer to the Relay Assembly Removal in the DFI Power Source section.

Fuel Pump Relay Inspection

- Refer to the Relay Assembly Inspection in the DFI Power Source section.



1. Relay Assembly
2. Joint Connector F
3. Connector C
4. Connector D
5. Joint Connector R
6. Main Fuse 20 A

7. Battery
8. ECU
9. Joint Connector P
10. Fuel Pump
11. Joint Connector S

3-88 FUEL SYSTEM (DFI)

Fuel Tank

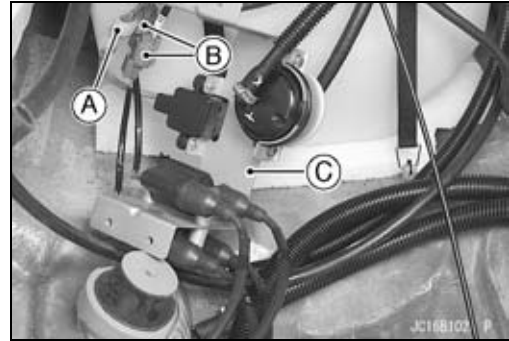
Fuel Tank Removal

- Drain the fuel tank into a suitable container.

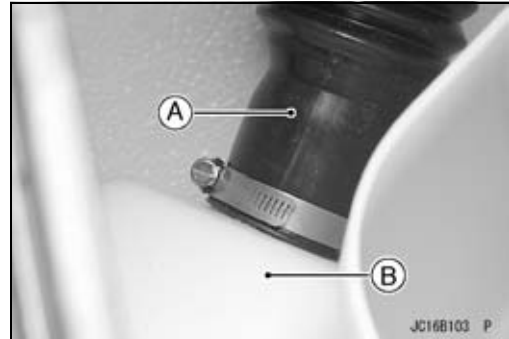
⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

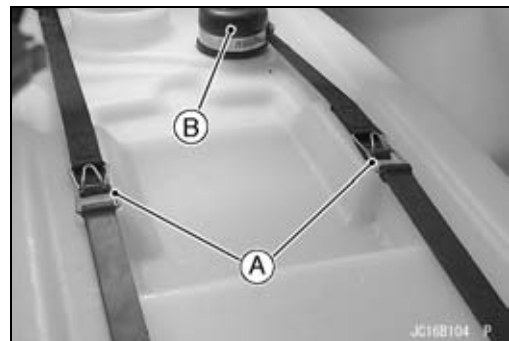
- Remove the engine (see Engine Removal/Installation chapter).
- Remove the fuel pump (see Fuel Pump Removal).
- Disconnect the following from the main harness.
 - Vehicle-down Sensor Lead Connector [A]
 - Ignition Coil Lead Connectors [B]
- Remove the bracket [C] out of the engine compartment.



- Remove the fuel filler tube [A] from the fuel tank [B].

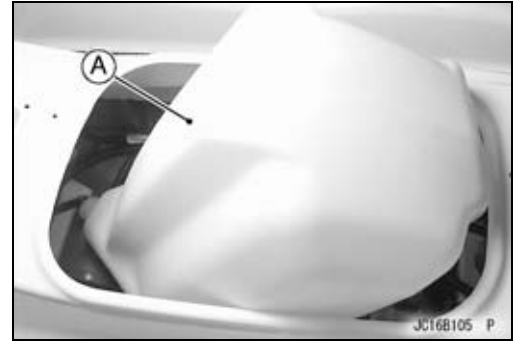


- Unhook the fuel tank straps [A].
- Remove the fuel level sensor [B].



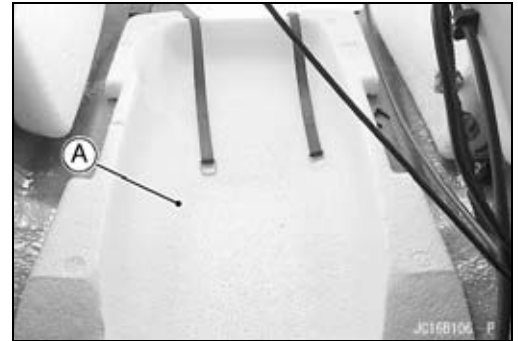
Fuel Tank

- Remove the fuel tank [A] out of the hull as shown.



Fuel Tank Installation

- Be sure the float [A] in place before putting the fuel tank into the hull.
- Route the following correctly (see Cable, Wire, and Hose Routing section in Appendix chapter).
 - Fuel Hoses
 - Fuel Tank Vent Hose
 - Fuel Level Sensor Leads
 - Other Wire and Harness
- For JT1500-A2 model ~; Replace the double spring clamps with new ones. (see Fuel System Diagram)



Fuel Tank Cleaning

- Remove the fuel tank (see Fuel Tank Removal).
- Drain the tank into a suitable container.

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or spark; this includes any appliance with a pilot light.

- Flush the tank repeatedly with high-flash-point solvent until it is clean. It may be necessary to put a few marbles or pieces of clean gravel into the tank and shake it, to knock loose any foreign matter in the bottom.

⚠ WARNING

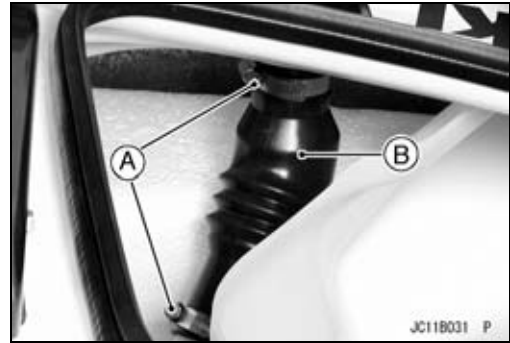
Clean the tank in a well-ventilated area, and take ample care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean the tank. A fire or explosion could result.

3-90 FUEL SYSTEM (DFI)

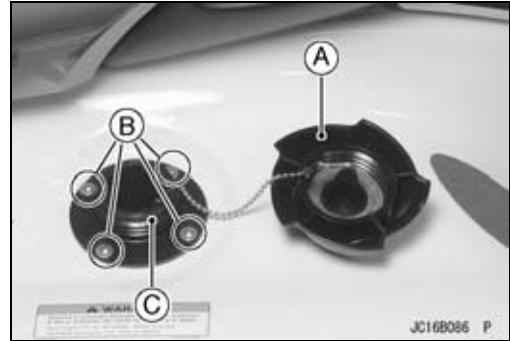
Fuel Tank

Fuel Filler and Tube Removal

- Open the front storage compartment cover.
- Loosen the fuel filler tube clamp screws [A] and remove the fuel filler tube [B].



- Remove the fuel filler cap [A].
- Take out the screws [B] in the filler flange and remove the fuel filler [C].



Fuel Filler and Tube Installation

- Clean the deck and filler on their mating surfaces with greaseless, high-flash point solvent.

⚠ WARNING

Clean the parts in a well-ventilated area, and take ample care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent. A fire or explosion could result.

- Replace the fuel filler gasket [A] with a new one.
- Visually inspect the fuel filler cap gasket [B] for damage.
- ★ If there is any doubt as to the condition of the fuel filler gasket, replace the gasket with a new one.
- Tighten the fuel filler tube clamp screws.

Torque - Fuel Filler Tube Clamp Screws: 2.9 N·m (0.30 kgf·m, 26 in·lb)



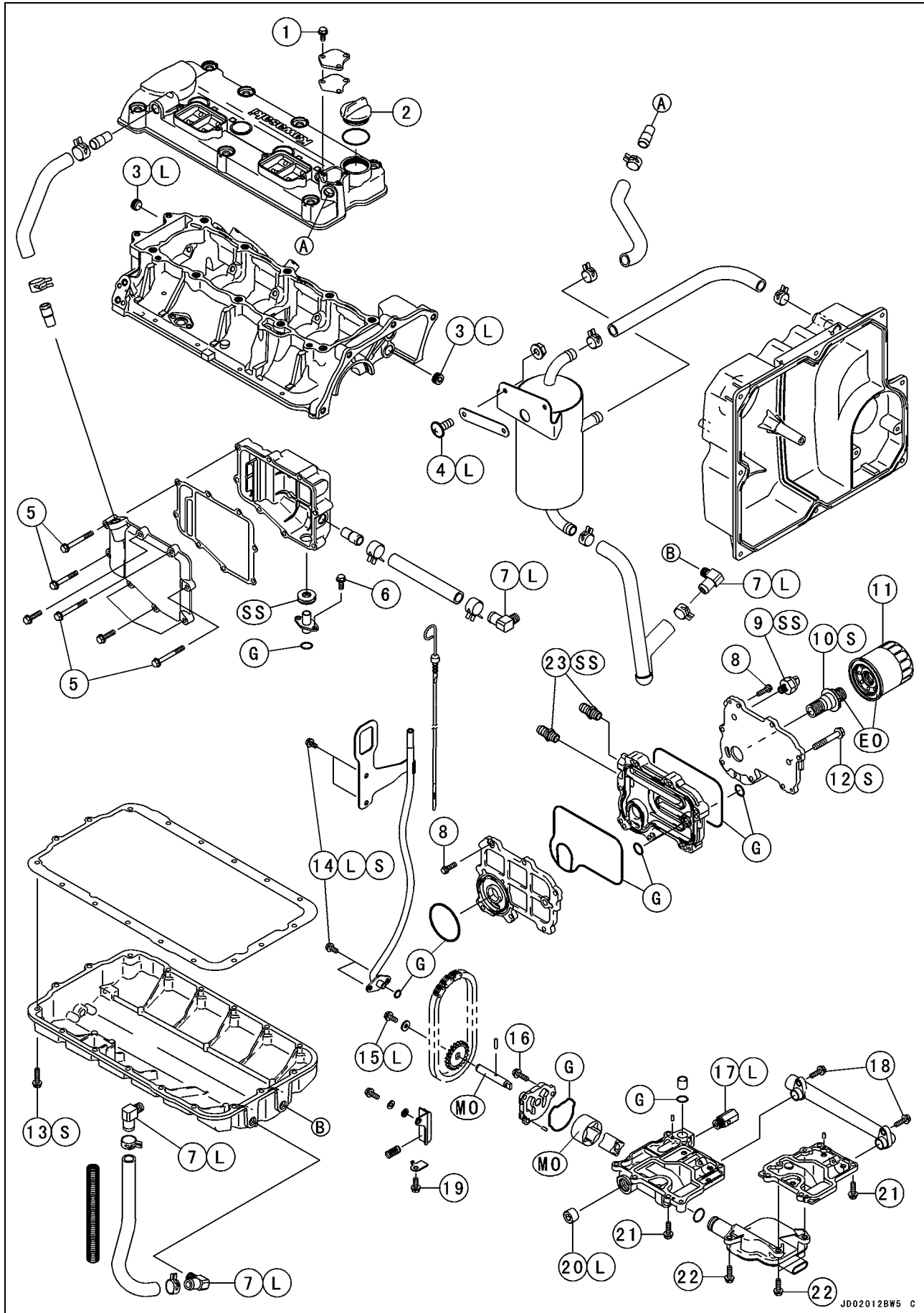
Engine Lubrication System

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4-2 ENGINE LUBRICATION SYSTEM

Exploded View



ENGINE LUBRICATION SYSTEM 4-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Breather Plate Bolts	7.8	0.80	69 in·lb	
2	Oil Filler Cap	1.0	0.10	87 in·lb	
3	Oil Passage Plugs	20	2.0	14	L
4	Oil Separator Tank Mounting Screws	4.9	0.50	43 in·lb	L
5	Breather Case Mounting Bolts	7.8	0.80	69 in·lb	
6	Breather Pipe Bolts	8.8	0.90	78 in·lb	
7	Oil Passage Joints	11	1.1	95 in·lb	L
8	Oil Cooler Assembly Bolts	7.8	0.80	69 in·lb	
9	Oil Pressure Switch	15	1.5	11	SS
10	Oil Passage Bolt	78	8.0	58	S
11	Oil Filter	18	1.8	13	EO
12	Oil Cooler Positioning Bolt	20	2.0	14	S
13	Oil Pan Bolts	7.8	0.80	69 in·lb	S
14	Dipstick Tube Bolts	7.8	0.80	69 in·lb	L, S
15	Oil Pump Sprocket Bolt	15	1.5	11	L
16	Oil Pump Cover Bolts	7.8	0.80	69 in·lb	
17	Oil Pressure Relief Valve	15	1.5	11	L
18	Oil Pipe Bolts	7.8	0.80	69 in·lb	
19	Chain Guide Spring Plate Bolt	7.8	0.80	69 in·lb	
20	Oil Pump Body Plug	20	2.0	14	L
21	Oil Pump Body Bolts	7.8	0.80	69 in·lb	
22	Oil Screen Bolts	7.8	0.80	69 in·lb	
23	Water Hose Joints	20	2.0	14	SS

EO: Apply engine oil.

G: Apply grease.

L: Apply a non-permanent locking agent.

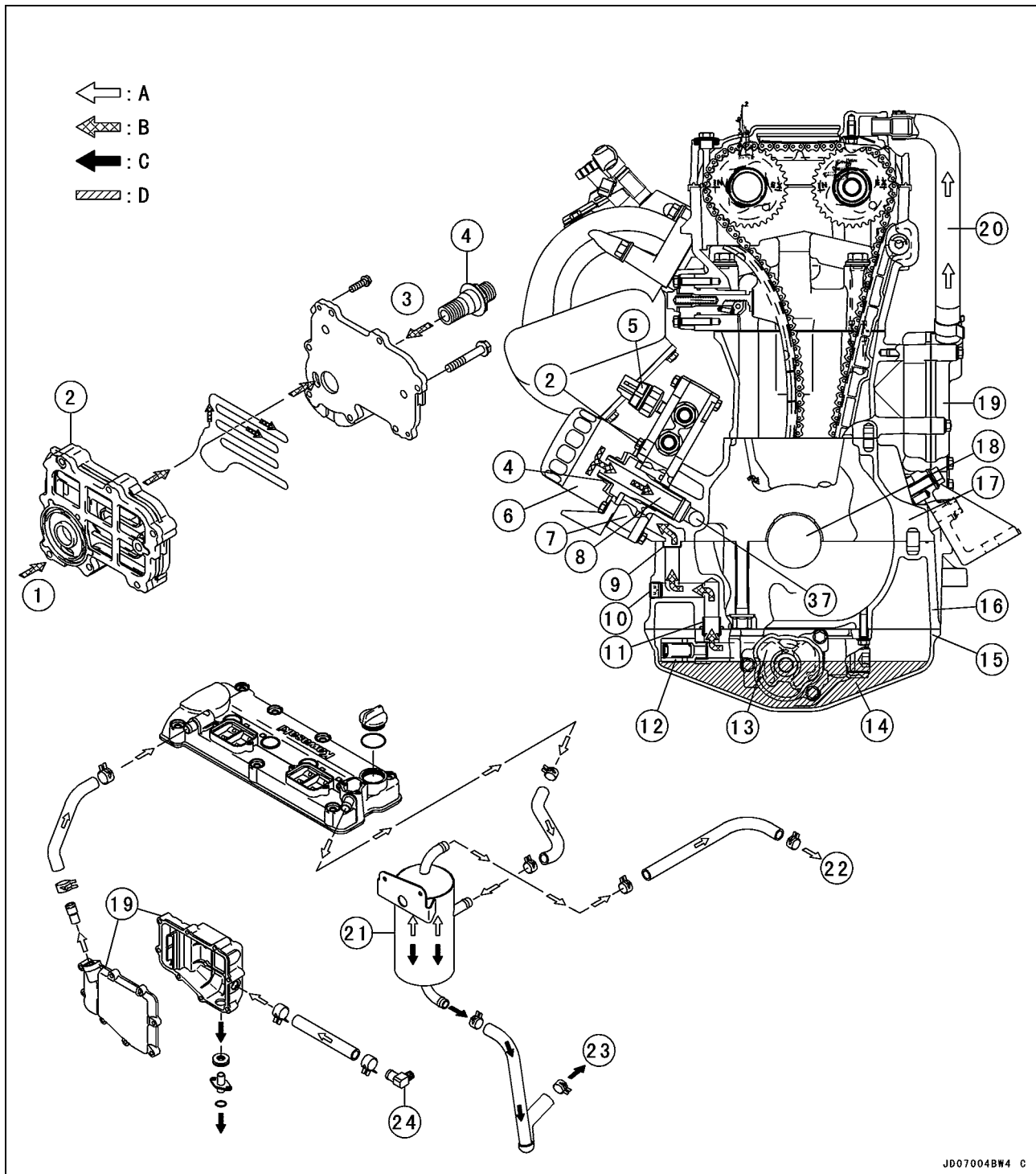
MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).

S: Follow the specific tightening sequence.

SS: Apply silicone sealant (see text).

4-4 ENGINE LUBRICATION SYSTEM

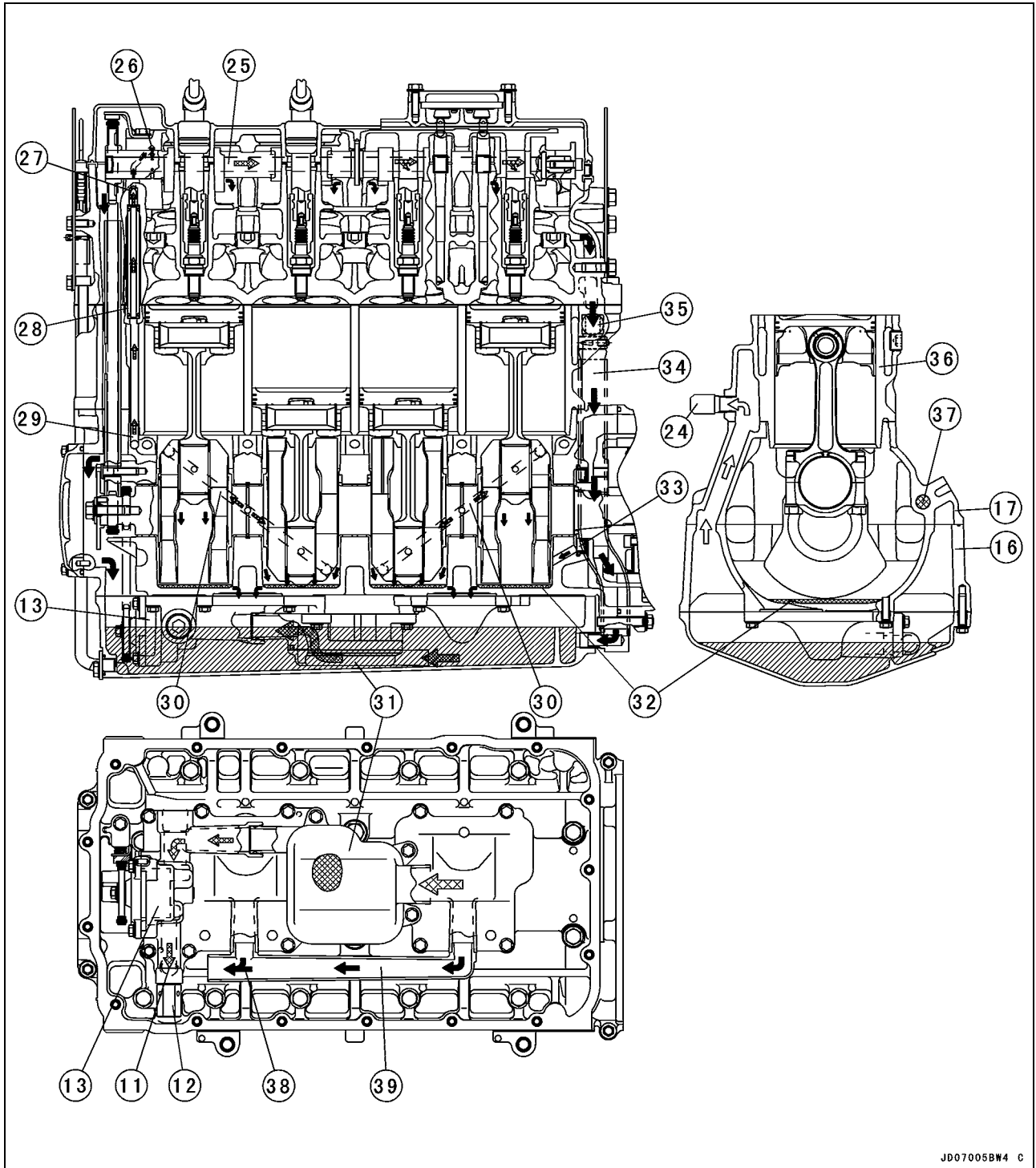
Engine Oil Flow Chart



JD07004BW4 C

- | | | |
|-------------------------------|---|-------------------------------|
| A: Blowby Gas | 6. Oil Filter | 12. Oil Pressure Relief Valve |
| B: Supply Engine Oil Flow | 7. Oil Passage (to Oil Filter) | 13. Oil Pump |
| C: Return Engine Oil Flow | 8. Oil Passage (to Main Oil Passage) | 14. Oil Sump (in Oil Pan) |
| D: Oil Sump | 9. Oil Pipe (from Lower Crankcase to Upper Crankcase) | 15. Oil Pan |
| 1. from Oil Pump Side Passage | 10. Oil Passage Plug | 16. Lower Crankcase |
| 2. Oil Cooler | 11. Oil Pipe (from Oil pump to Lower Crankcase) | 17. Upper Crankcase |
| 3. to Main Oil Passage | | 18. Crankshaft |
| 4. Oil Passage Bolt | | 19. Breather Case |
| 5. Oil Pressure Switch | | 20. Breather Hose |

Engine Oil Flow Chart



- | | | |
|---------------------------|--------------------------------|-----------------------------|
| 21. Oil Separator Tank | 28. Oil Pipe (from Cylinder to | 34. Oil Hose (from Cylinder |
| 22. to Air Filter | Cylinder Head) | to Oil Pan) |
| 23. to Oil Pan | 29. Oil Passage (from Main | 35. Cylinder Oil Passage |
| 24. Joint | Oil Passage to Oil Pipe) | Joint |
| 25. Camshaft Oil Passage | 30. Crankshaft Oil Passage | 36. Cylinder |
| 26. Camshaft Cap Oil Pas- | 31. Oil Screen | 37. Main Oil Passage |
| sage | 32. Oil Sump (in Crank | 38. to Oil Pan Sump |
| 27. Oil Passage (from Oil | Room) | 39. Oil Pipe |
| Pipe to Camshaft Cap) | 33. Oil Seal | |

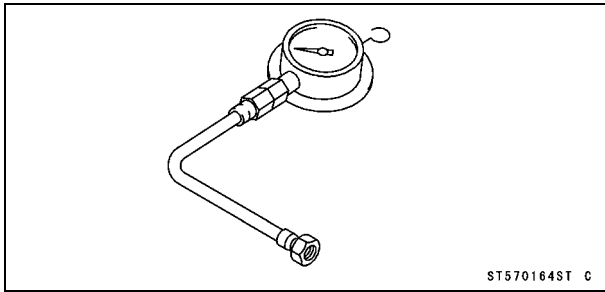
4-6 ENGINE LUBRICATION SYSTEM

Specifications

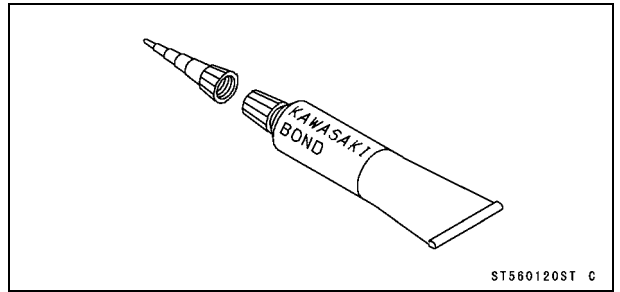
Item	Standard
Engine Oil Grade Viscosity Capacity Level	API SE, SF, or SG API SH or SJ with JASO MA SAE 10W-40 4.0 L (4.2 US qt, with or without the filter) 5.0 L (5.3 US qt, when engine is completely dry) Between upper and lower level lines (see text)
Oil Pressure Measurement Oil pressure @3 000 r/min (rpm), oil temperature 74°C (165°F)	461 kPa (4.7 kgf/cm ² , 67 psi)

Special Tool and Sealant

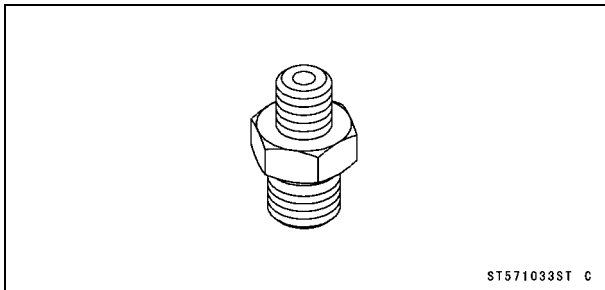
**Oil Pressure Gauge, 10 kgf/cm²:
57001-164**



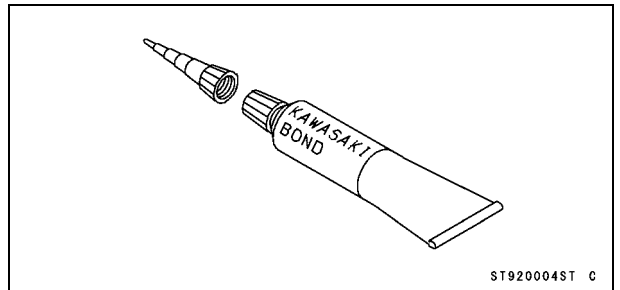
**Kawasaki Bond (Silicone Sealant):
56019-120**



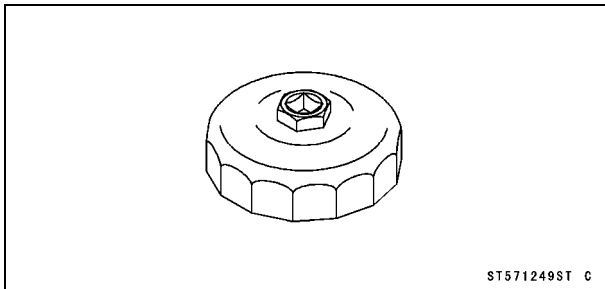
**Oil Pressure Gauge Adapter, PT 1/8:
57001-1033**



**Kawasaki Bond (Silicone Sealant):
92104-0004**



**Oil Filter Wrench:
57001-1249**



4-8 ENGINE LUBRICATION SYSTEM

Engine Oil and Oil Filter

⚠ WARNING

Watercraft operation with insufficient, deteriorated, or contaminated engine oil will cause accelerated wear and may result in engine seizure, accident, and injury.

Oil Level Inspection

This watercraft engine is equipped with a semi-dry sump. In the semi-dry sump engine, the oil level difference is very large between the level measured after just stopping and that after leaving for a long time.

It is necessary to check the specified amount of oil is in the engine before starting the engine every day. At this time use the cold mark of the level gauge. Then run the engine to lubricate the engine parts sufficiently. After that it is necessary to check the level by using hot mark of the level gauge.

Preliminary Check

- Remove the seat (see Hull/Engine Hood chapter).
- Whenever checking the engine oil level, keep the watercraft level side to side and fore to aft as much as possible.

Level Ground [A]

Side Bumper [B]

Parallel [C]

- Remove the dipstick [A], wipe it dry and insert it back to the dipstick tube [B], and then remove it again to check the oil level.

- The oil level must be between the High [A] and Low [B] level lines on the dipstick [C] (Use level lines when engine is cold).

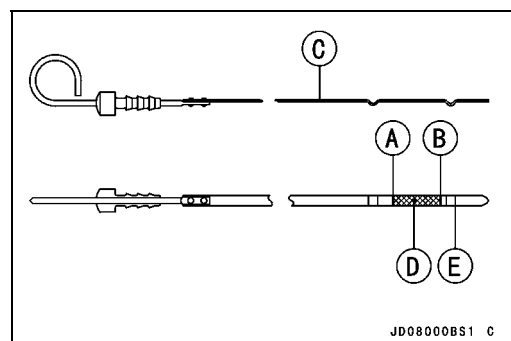
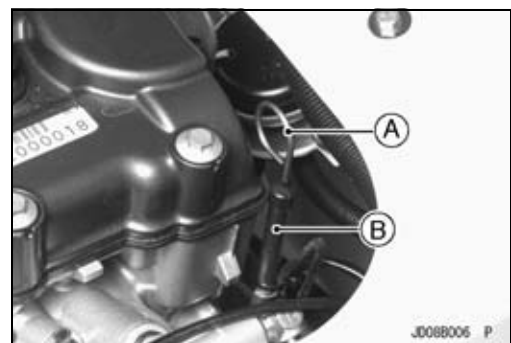
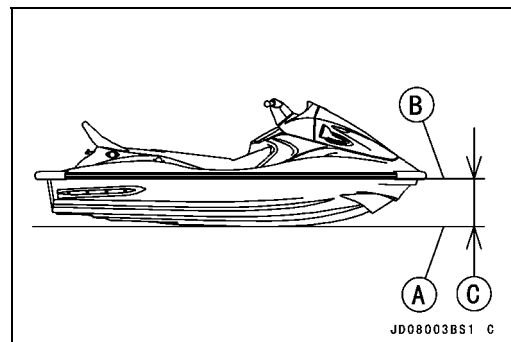
High Level Line when Cold [A]

Low Level Line when Cold [B]

Dipstick [C]

High Level Line when Hot [D]

Low Level Line when Hot [E]



Engine Oil and Oil Filter

CAUTION

Racing the engine before the oil reaches every part can cause engine seizure.
 If the engine oil gets extremely low or if the oil pump or oil passages clog up or otherwise do not function properly, the oil pressure warning light will light. If this light stays on when the engine is running above idle speed, stop the engine immediately and find the cause.

- ★ If the oil level is too high, remove the excess oil using a syringe or some other suitable device.
- ★ If the oil level is too low, add the oil to the low level line through the oil filter opening (see Periodic Maintenance chapter). Use the same type and make of oil that is already in the engine.

NOTE

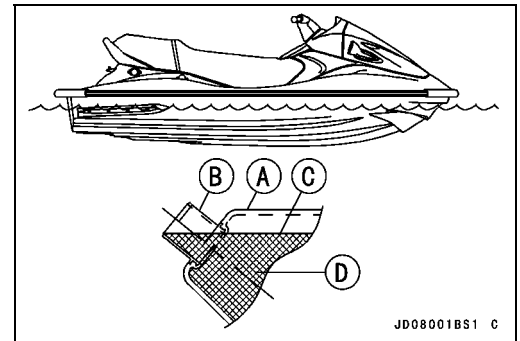
○ If the engine oil type and make are unknown, use any brand of the specified oil to top off the level in preference to running the engine with the oil level low. Then at your earliest convenience, change the oil completely.

Ordinary (standard) Check

- The preliminary is checked before the ordinary check.
- Install the removed parts.
- Launch the watercraft.
- Start the engine for several minutes.
- Ride the watercraft and run the engine at about 5 000 rpm for 5 minutes.
- Stop the engine and let it cool down for 10 minutes.
- Steady the watercraft in calm water to prevent movement, or on the ground, keep the watercraft level side to side and fore to aft as much as possible.

NOTE

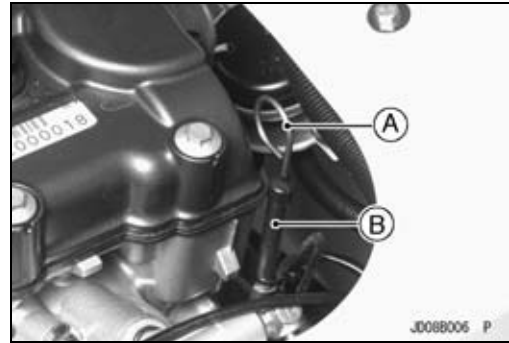
- Since the trim and list of the watercraft will significantly affect the oil level, be sure that the operator and/or cargo are not aboard the watercraft when measuring the oil level.
- Also make the fuel tank [A] full if it is not full as shown to keep the watercraft level.
 Fuel Tank Filler Neck [B]
 Fuel Full Level [C]
 Fuel [D]
- This measuring procedure with the watercraft afloat should be followed when the oil level is found low and to be added.



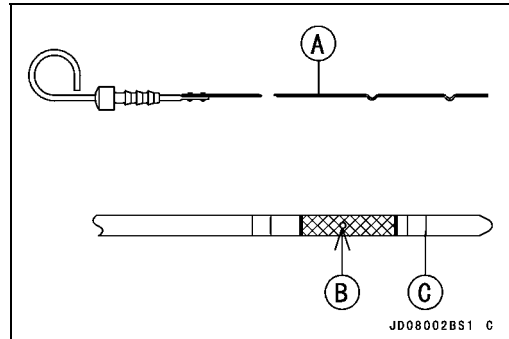
4-10 ENGINE LUBRICATION SYSTEM

Engine Oil and Oil Filter

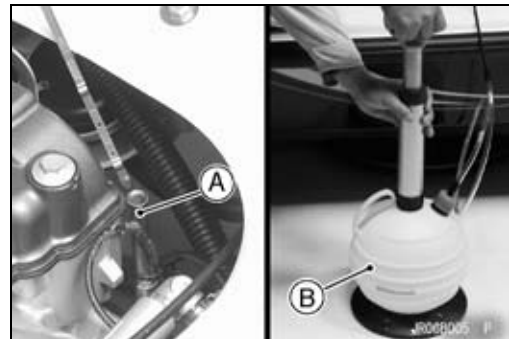
- Remove the seat (see Hull/Engine Hood chapter)
- Remove the dipstick [A], wipe it dry and insert it back to the dipstick tube [B], and then remove it again to check the oil level.



- Check the oil level using the hot level mark on the dipstick [A].
 - High Level Line when Hot [B]
 - Low Level Line when Hot [C]



- ★ If the oil level is too high, drain the excess oil thoroughly from the dipstick tube [A] using a commercially-available vacuum pump [B].



- ★ If the oil level is too low, add the oil to the high level line through the oil filler opening (see Periodic Maintenance chapter). Use the same type and make of oil that is already in the engine.

NOTE

○ If the engine oil type and make are unknown, use any brand of the specified oil to top off the level in preference to running the engine with the oil level low. Then at your earliest convenience, change the oil completely.

Engine Oil Change

- Refer to Engine Oil Change in the Periodic Maintenance chapter.

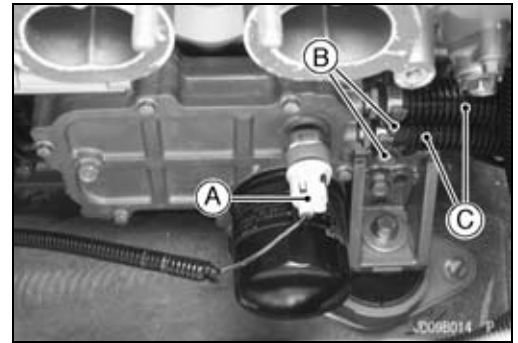
Oil Filter Replacement

- Refer to Oil Filter Replacement in the Periodic Maintenance chapter.

Oil Cooler

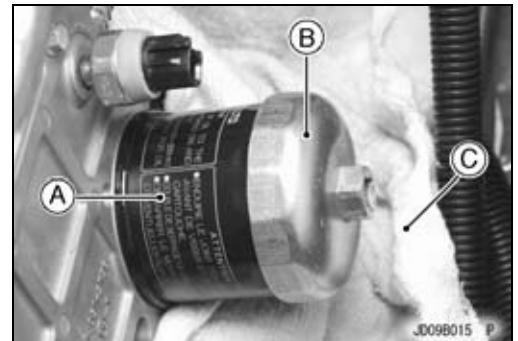
Oil Cooler Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Air Filter with Inlet Duct (see Fuel System (DFI) chapter)
 - Inlet Manifold (see Fuel System (DFI) chapter)
- Disconnect the oil pressure switch connector [A].
- Loosen the clamp screws [B] and remove the oil cooler cooling hoses [C] from the oil cooler.

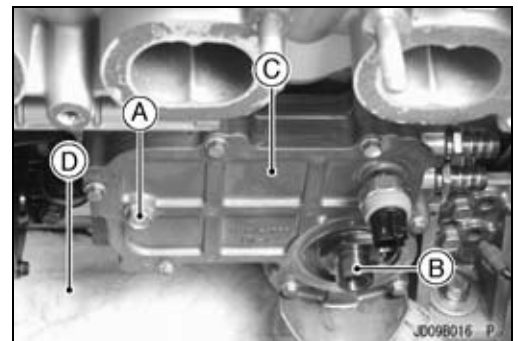


- Remove the oil filter [A] with the oil filter wrench [B].
- Place a rag or cloth [C] under the oil filter to receive the remaining oil.

Special Tool - Oil Filter Wrench: 57001-1249

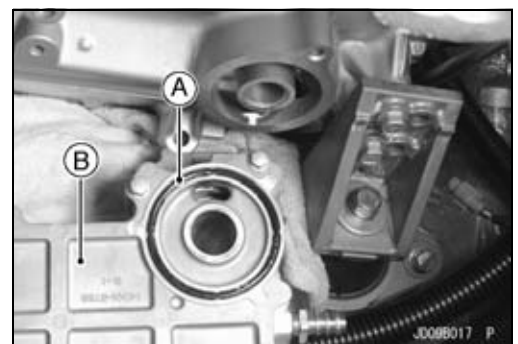


- Unscrew the oil cooler positioning bolt [A].
- Unscrew the oil passage bolt [B] and remove the oil cooler [C].
- Place a rag or cloth [D] under the oil cooler to receive the remaining oil.



Oil Cooler Installation

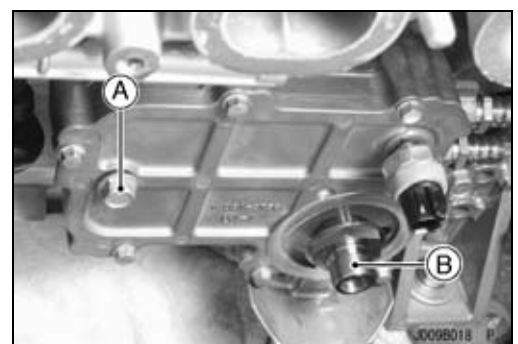
- Replace the O-ring [A] with new one and apply grease to new O-ring.
- Fit the O-ring on the oil cooler [B] securely.



- Install the oil cooler positioning bolt [A] and the oil passage bolt [B] temporarily.
- Tighten the passage bolt first.
- Next, tighten the positioning bolt.

Torque - Oil Passage Bolt: 78 N·m (8.0 kgf·m, 58 ft·lb)

Oil Cooler Positioning Bolt: 20 N·m (2.0 kgf·m, 14 ft·lb)

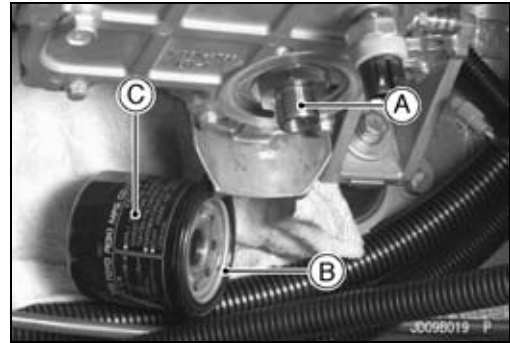


4-12 ENGINE LUBRICATION SYSTEM

Oil Cooler

- Apply engine oil to the thread [A] of the passage bolt and O-ring [B] of the oil filter [C].
- Tighten the oil filter (P/No. 16097-1072).

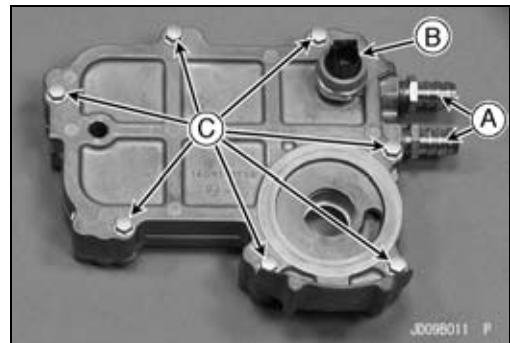
Torque - Oil Filter: 18 N·m (1.8 kgf·m, 13 ft·lb)



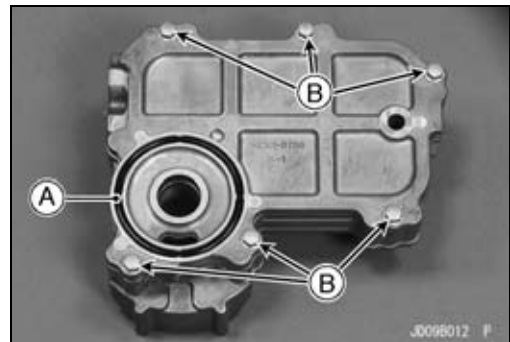
- Connect the oil pressure switch connector securely.
- Install the cooling hoses (see Cable, Wire and Hose Routing in Appendix chapter).
- Install the inlet manifold (see Fuel System (DFI) chapter).

Oil Cooler Disassembly

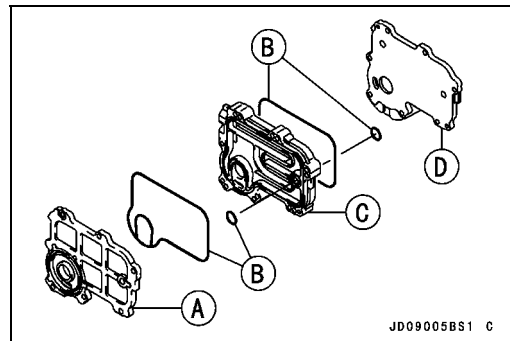
- Remove:
 - Oil Cooler (see Oil Cooler Removal)
 - Water Hose Joints [A]
 - Oil Pressure Switch [B]
 - Oil Cooler Assembly Bolts [C]



- Remove the O-ring [A].
- Turn the oil cooler up side down, and remove the assembly bolts [B].



- Separate the oil cooler.
 - Inside Oil Cooler Cover [A]
 - O-rings [B]
 - Oil Cooler [C]
 - Outside Oil Cooler Cover [D]



Oil Cooler Assembly

- Apply grease to new O-rings, and fit them on to each groove of the coolers securely.
- Apply silicon sealant to the joints and tighten them.

Sealant - Kawasaki Bond (Silicone Sealant): 56019-120

Torque - Oil Cooler Assembly Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

Water Hose Joints: 20 N·m (2.0 kgf·m, 14 ft·lb)

- Install the oil cooler (see Oil Cooler Installation).

Oil Cooler

Oil Cooler Inspection

- Start the engine to check for water and oil leaks.
- ★ If the water and oil leak, replace the O-rings.

⚠ WARNING

Do not run the engine in a closed area. Exhaust gases contain carbon monoxide, a colorless, odorless, poisonous gas which can be lethal.

CAUTION

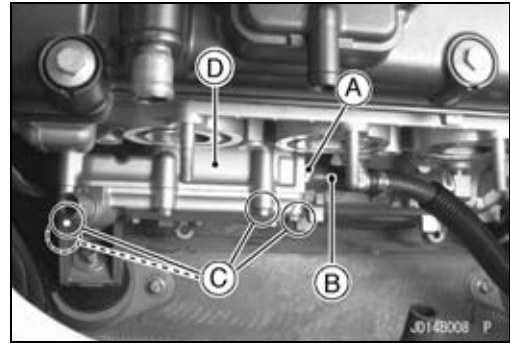
Do not run the engine without cooling water supply for more than 15 seconds, especially in high revolutionary speed or severe engine and exhaust system damage will occur.

4-14 ENGINE LUBRICATION SYSTEM

Breather Case and Oil Separator Tank

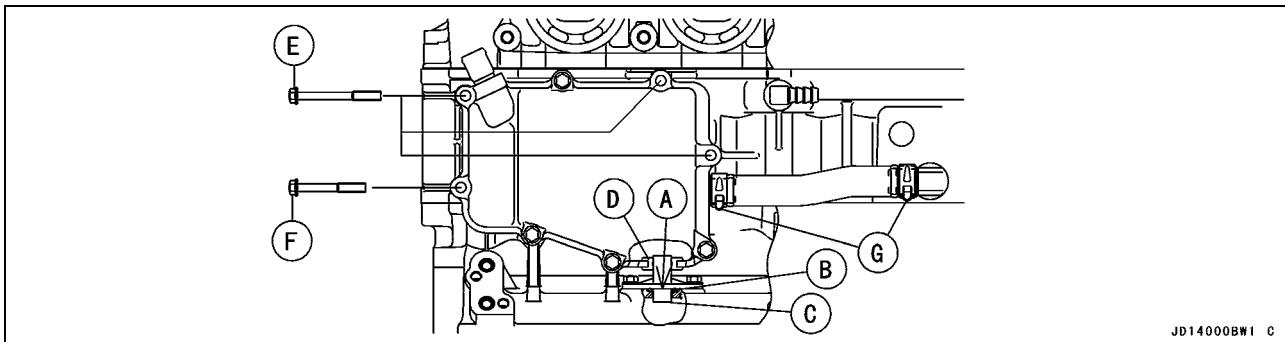
Breather Case Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Exhaust Manifold (see Exhaust System chapter)
 - Clamp [A]
 - Breather Hose [B]
 - Breather Case Mounting Bolts [C]
- Pull the breather case [D] upward.



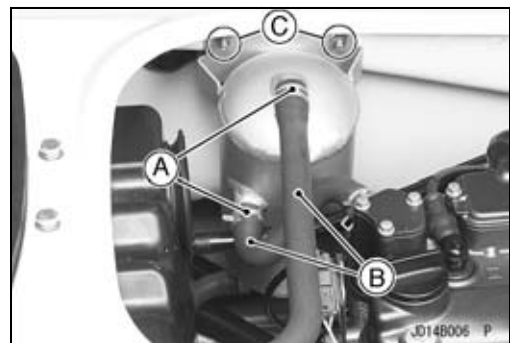
Breather Case Installation

- ★ If the breather pipe [A] removed, install the pipe as follow.
- Apply grease to the O-ring [B].
- Install the O-ring to the short length pipe side [C] of the breather pipe.
- Install the breather pipe so that the short length pipe side faces downward.
- Torque - Breather Pipe Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)**
- Apply silicone sealant to the inside of the rubber grommet [D].
- Sealant - Kawasaki Bond (Silicone Sealant): 92104-0004**
- Tighten the breather case mounting bolts.
 - M6 × 55 Bolts [E]
 - M6 × 45 Bolt [F]
- Torque - Breather Case Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)**
- Install the breather hose clamp pinch head [G] as shown.



Oil Separator Tank Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Breather Hose Clamps [A] (slide out)
 - Breather Hoses [B]
 - Mounting Screws
 - Bracket
- Be careful not to drop the nuts [C].

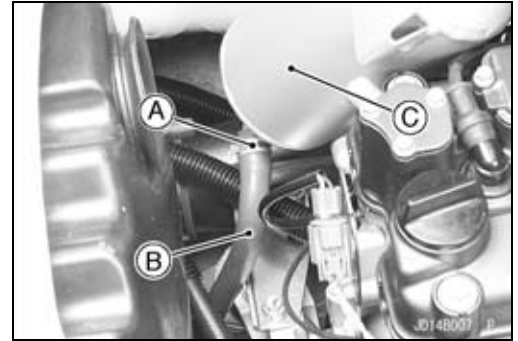


Breather Case and Oil Separator Tank

- Remove:
 - Breather Hose Clamp [A]
 - Breather Hose [B]
 - Oil Separator Tank [C]

NOTE

○ Hold the hose end to the upward. The oil will flow out if the hose lies at the bottom.



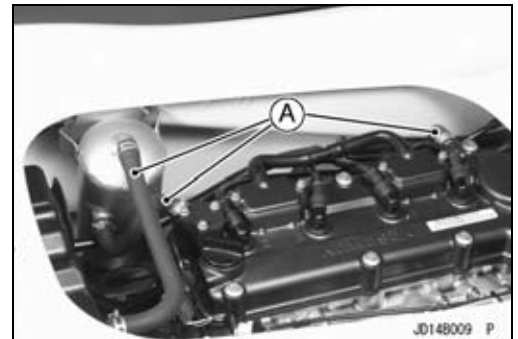
Oil Separator Tank Installation

- When installing the breather hoses, avoid sharp bending, kicking, flattening or twisting, and route the hoses according to Hose Routing section in Appendix chapter.
- Apply a non-permanent locking agent to the oil separator tank mounting screws.
- Tighten:
 - Be careful not to drop the nuts.

Torque - Oil Separator Tank Mounting Screws: 4.9 N·m (0.50 kgf·m, 43 in·lb)

Blowby Gas System Inspection

- Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly.
 - ★ If they are not, correct them.
 - Inspect the breather hoses [A], breather pipes and the air filter drain caps for damage or signs of deterioration. Squeeze the hoses. These hoses should not be hard and brittle, nor should be soft or swollen.
 - ★ Replace any damaged hoses.
 - Check that the hoses and caps are securely connected.
- The air filter drain caps [A] is provided beneath the air filter are housing catches the water or oil from the bottom of the air filter housing. Usually water or oil does not collect at the bottom of the housing. In the event that water is drawn in through the duct, or if engine oil is blown back, drain the housing.
- Pull the air filter drain plugs to drain the water or breather oil when changing engine oil.

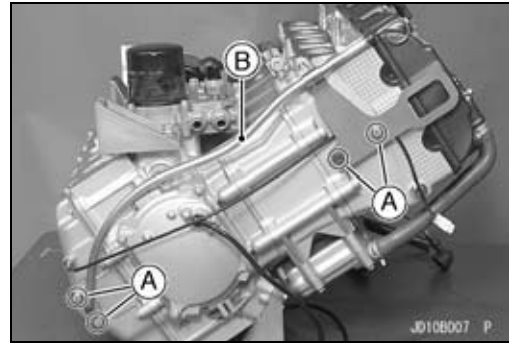


4-16 ENGINE LUBRICATION SYSTEM

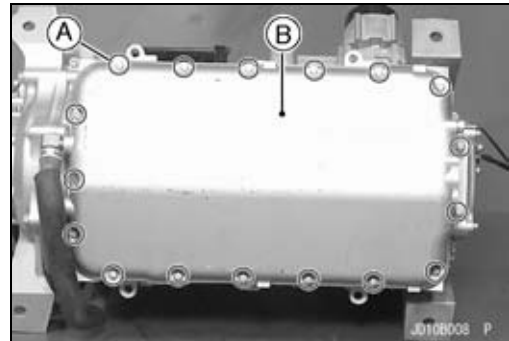
Oil Pan

Oil Pan Removal

- Remove:
 - Engine Oil (drain, see Periodic Maintenance chapter)
 - Engine (see Engine Removal/Installation chapter)
- Turn the engine to the side.
- Unscrew the dipstick tube bolts [A] and pull out the dipstick tube [B].



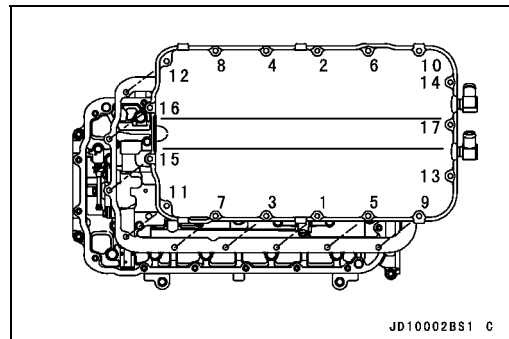
- Unscrew the oil pan bolts [A] and remove the oil pan [B].



Oil Pan Installation

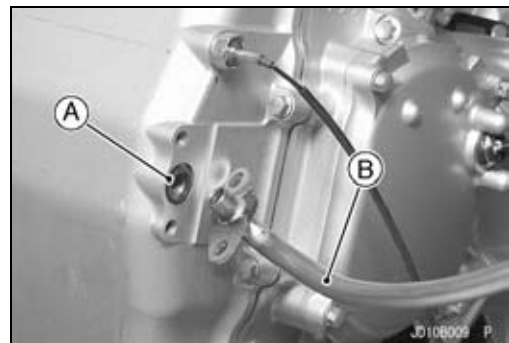
- Tighten the oil pan bolts following the tightening sequence [1 ~ 17].

Torque - Oil Pan Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)



- Apply grease to the O-ring [A] on the dipstick tube [B].
- Apply a non-permanent locking agent to the dipstick tube bolts.
- Tighten all the dipstick tube bolts temporary.
- First, tighten the oil pan side bolt. Next, tighten the cylinder head side bolts.

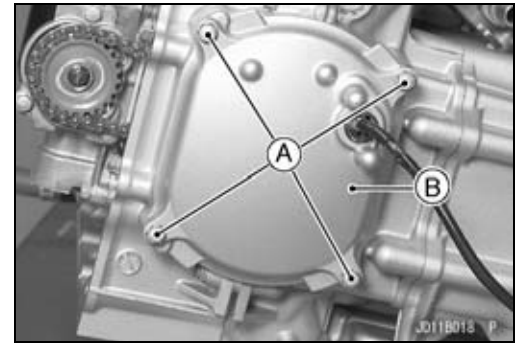
Torque - Dipstick Tube Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)



Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

Oil Pump Sprocket Removal

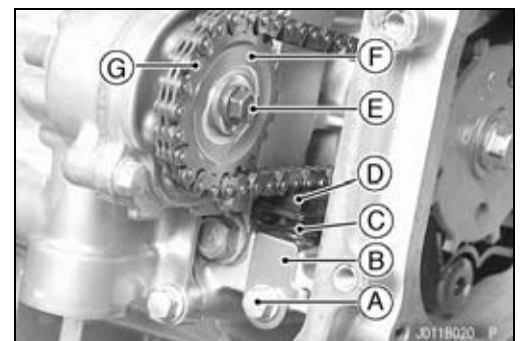
- Drain:
 - Engine Oil (see Periodic Maintenance chapter)
- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Oil Pan (see Oil Pan Removal)
 - Crankshaft Sensor Cover Bolts [A]
 - Crankshaft Sensor Cover [B]



- Unscrew the oil pump chain guide bolt [A],



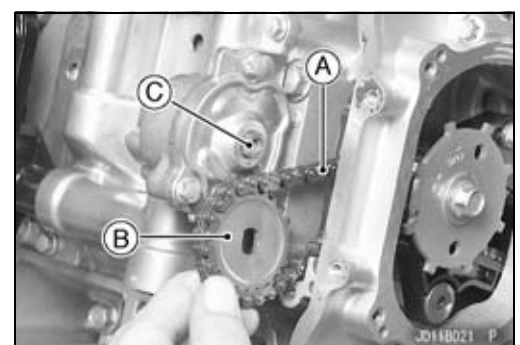
- Unscrew the spring plate bolt [A] and remove the spring plate [B], spring [C] and the oil pump chain guide [D].
- Unscrew the oil pump sprocket bolt [E].
- Pull out the oil pump sprocket [F] together with the oil pump sprocket chain [G].



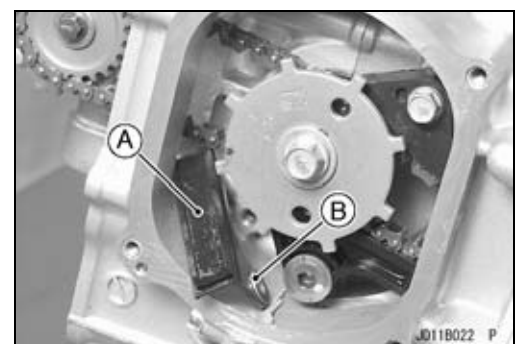
Oil Pump Sprocket Installation

- Engage the oil pump chain [A] to the oil pump sprocket [B].
- Install the sprocket with the chain to the oil pump shaft [C].
- Apply a non-permanent locking agent to the sprocket bolt.
- Tighten:

Torque - Oil Pump Sprocket Bolt: 15 N·m (1.5 kgf·m, 11 ft·lb)



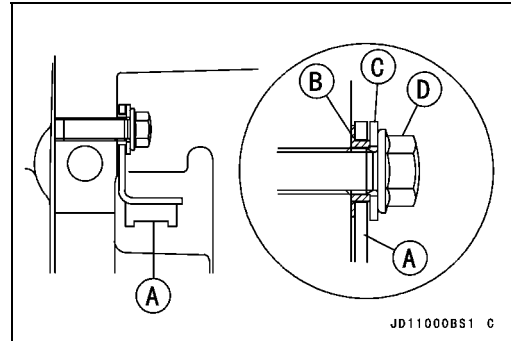
- Install the oil pump chain guide [A] and collar [B] as shown.



4-18 ENGINE LUBRICATION SYSTEM

Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

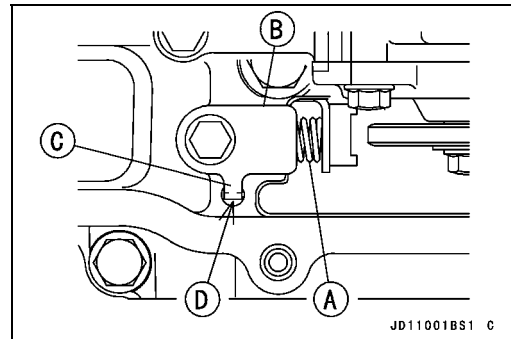
- Install the oil pump chain guide [A], collar [B], washer [C], and bolt [D] as shown.



- Install the chain guide spring [A] and the spring plate [B].
- Insert the tab [C] of the spring plate in the hole [D] of the crankcase.

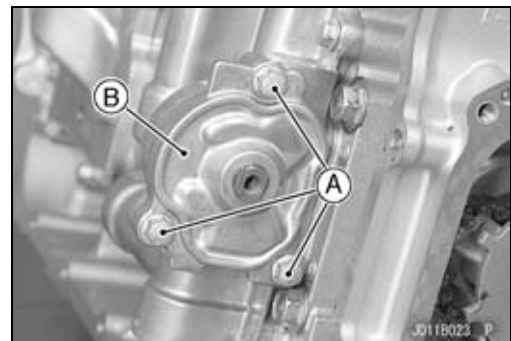
Torque - Chain Guide Spring Plate Bolt: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Install:
Oil Pan (see Oil Pan Installation)

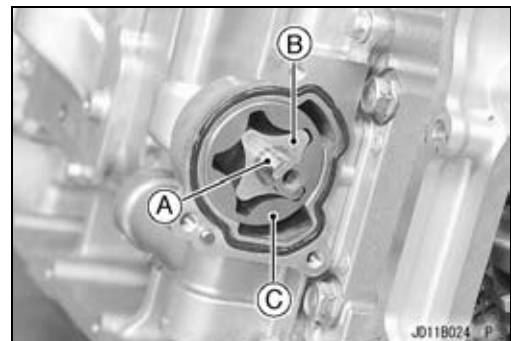


Oil Pump Removal

- Drain:
Engine Oil (see Periodic Maintenance chapter)
- Remove:
Engine (see Engine Removal/Installation chapter)
Oil Pan (see Oil Pan Removal)
Oil Pump Sprocket (see Oil Pump Sprocket Removal)
Oil Pump Cover Bolts [A]
- Pull out the oil pump cover [B].

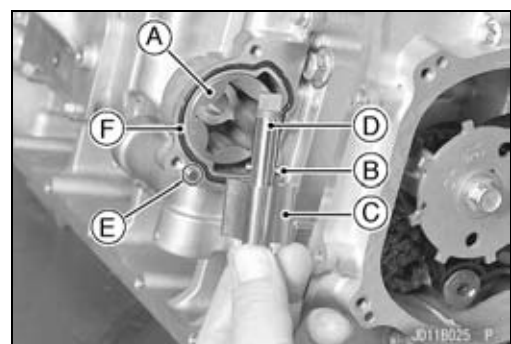


- Pull out the oil pump shaft [A] with inner rotor [B].
- Remove the outer rotor [C].



Oil Pump Installation

- Apply molybdenum disulfide oil solution to the outer and the inner rotors out side.
- Install the outer rotor [A] into the oil pump body.
- Apply molybdenum disulfide oil solution to the shaft.
- Assemble the pin [B], inner rotor [C] onto the oil pump shaft [D].
- Fit the pin into the slot of the inner rotor.
- Insert the shaft assembly.
- Be sure the dowel pin [E] is in place in the pump body.
- Fit the new O-ring [F] to the groove of the pump body.
- Fit the oil pump cover and tighten the cover bolts.



Torque - Oil Pump Cover Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

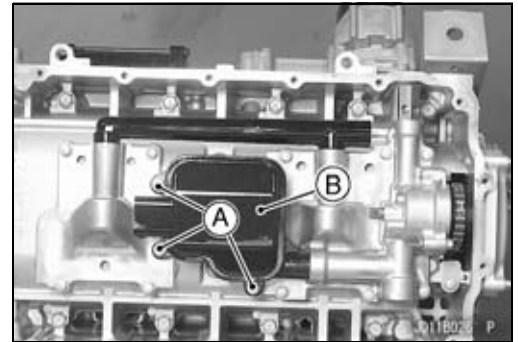
- Install:
 - Oil Pump Sprocket (see Oil Pump Sprocket Installation)
 - Oil Pan (see Oil Pan Installation)

Oil Pump Inspection

- Remove the oil pump parts.
- Visually inspect the oil pump outer, inner rotors and cover.
- ★ If there is any damage or uneven wear, replace the rotors and cover.

Oil Screen Removal

- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Oil Pan (see Oil Pan Removal)
 - Oil Screen Bolts [A]
- Pull out the soil screen [B] to the coupling side.

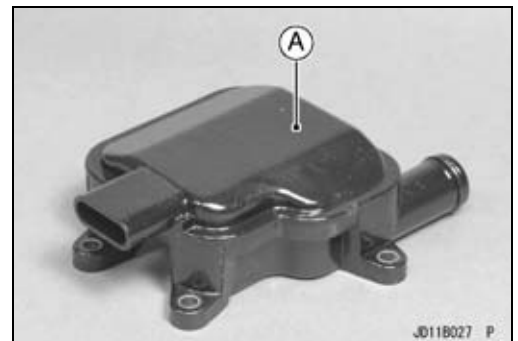


Oil Screen Installation

- Clean the oil screen [A] with high-flash point solvent and remove any particles stuck to it.

⚠ WARNING

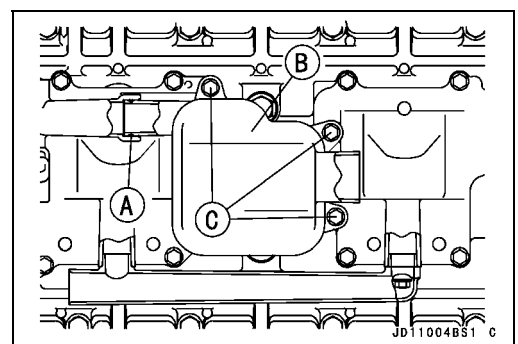
Clean the screen in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvents.



NOTE

○ While cleaning the screen, check for any metal particles that might indicate internal engine damage.

- Apply grease to the O-ring [A].
- Install the oil screen [B].
- Tighten:
 - Torque - Oil Screen Bolts [C]: 7.8 N·m (0.80 kgf·m, 69 in·lb)**
- Install:
 - Oil Pan (see Oil Pan Installation)

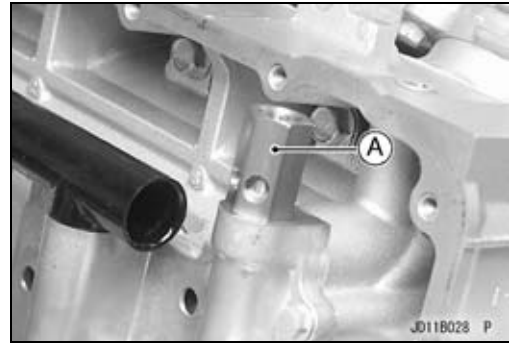


4-20 ENGINE LUBRICATION SYSTEM

Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

Oil Pressure Relief Valve Inspection

- Remove:
 - Oil Pan (see Oil Pan Removal)
 - Relief Valve [A]

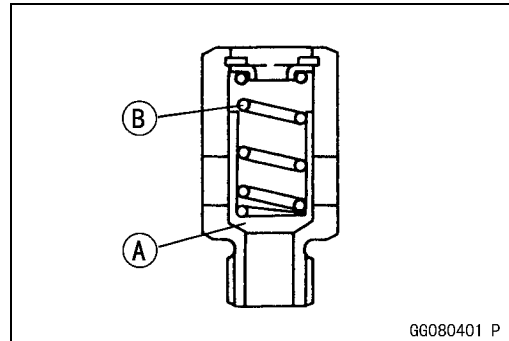


- Check to see if the valve [A] slides smoothly when pushing it in with a wooden or other soft rod, and see if it comes back to its seat by spring [B] force.

NOTE

○ Inspect the valve in its assembled state. Disassembly and assembly may change the valve performance.

- ★ If any rough spots are found during above inspection, wash the valve clean with a high-flash point solvent and blow out any foreign particles that may be in the valve with compressed air.



⚠ WARNING

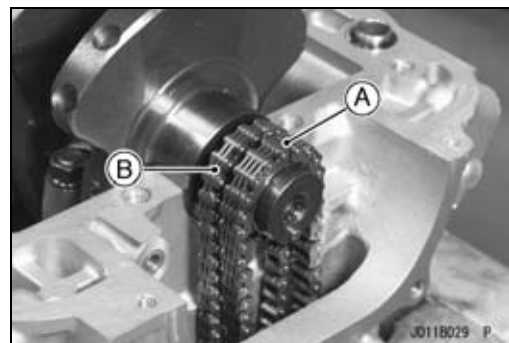
Clean the relief valve in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvent.

- ★ If cleaning does not solve the problem, replace the relief valve as an assembly. The relief valve is precisely made with no allowance for replacement of individual parts.
- Apply a non-permanent locking agent to the relief valve.
- Install the relief valve.

Torque - Oil Pressure Relief Valve: 15 N·m (1.5 kgf·m, 11 ft·lb)

Oil Pump Sprocket Chain Removal

- Split the crankcase (see Engine Bottom End chapter).
- Remove the camshaft chain [A] and the oil pump sprocket chain [B].



Oil Pressure Measurement

Oil Pressure Measurement

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Inlet Manifold (see Fuel System (DFI) chapter)
 - Oil Pressure Switch Connector [A] (disconnect)
 - Oil Pressure Switch [B]

- Install the oil pressure gauge adapter [A] to the switch hole.
 - Special Tool - Oil Pressure Gauge Adapter, PT 1/8: 57001-1033**

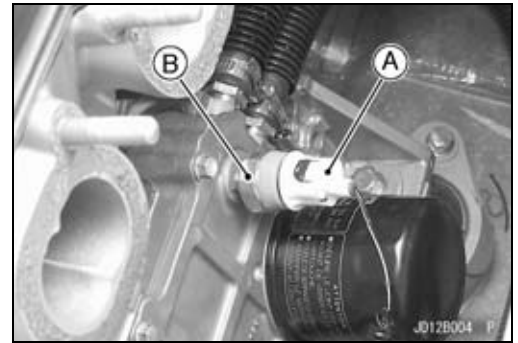
- Install the oil pressure gauge [A] to the adapter.
 - Special Tool - Oil Pressure Gauge, 10 kgf/cm²: 57001-164**
- Out off a rag or cloth.
- Install:
 - Inlet Manifold (see Fuel System (DFI) chapter)

- Launch the watercraft.
- Start the engine for several minutes.
- Run the engine at the specified speed, and read the oil pressure gauge.
- ★ If the oil pressure is significantly below the specification, inspect the oil pump and relief valve.
- ★ If the oil pump and relief valve are not at fault, inspect the rest of the lubrication system.

Oil Pressure

Standard: 461 kPa (4.7 kgf/cm², 67 psi) @3 000 r/min (rpm), oil temperature 74°C (165°F)

- Stop the engine.
- Raise the watercraft to the land.
- Remove:
 - Inlet Manifold
 - Oil Pressure Gauge and Adapter



4-22 ENGINE LUBRICATION SYSTEM

Oil Pressure Measurement

WARNING

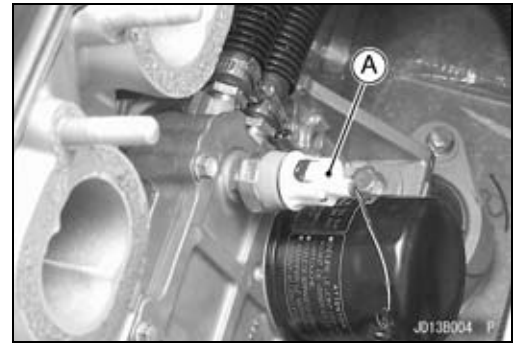
Take care against burns from hot engine oil that will drain through the oil passage when the gauge adapter is removed.

- Install:
 - Oil Pressure Switch (see Oil Pressure Switch Installation)
 - Inlet Manifold

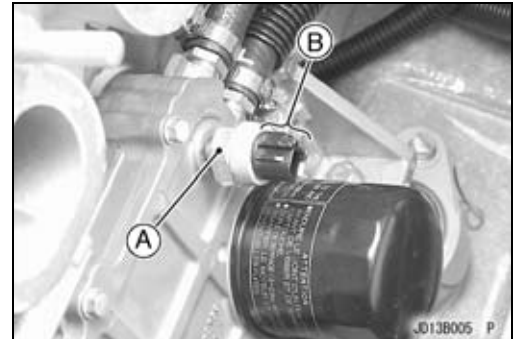
Oil Pressure Switch

Oil Pressure Switch Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Inlet Manifold (see Fuel System (DFI) chapter)
- Disconnect:
 - Switch Connector [A]



- Place a rag or cloth under the oil pressure switch [A] and remove the oil pressure switch.
- Do not damage the connect part [B] of the switch.



Oil Pressure Switch Installation

- Apply silicone sealant to the threads of the oil pressure switch and tighten it.
 - Sealant - Kawasaki Bond (Silicone Sealant): 56019-120**
 - Torque - Oil Pressure Switch: 15 N·m (1.5 kgf·m, 11 ft·lb)**
- Connect the switch connector.
- Install the removed parts.

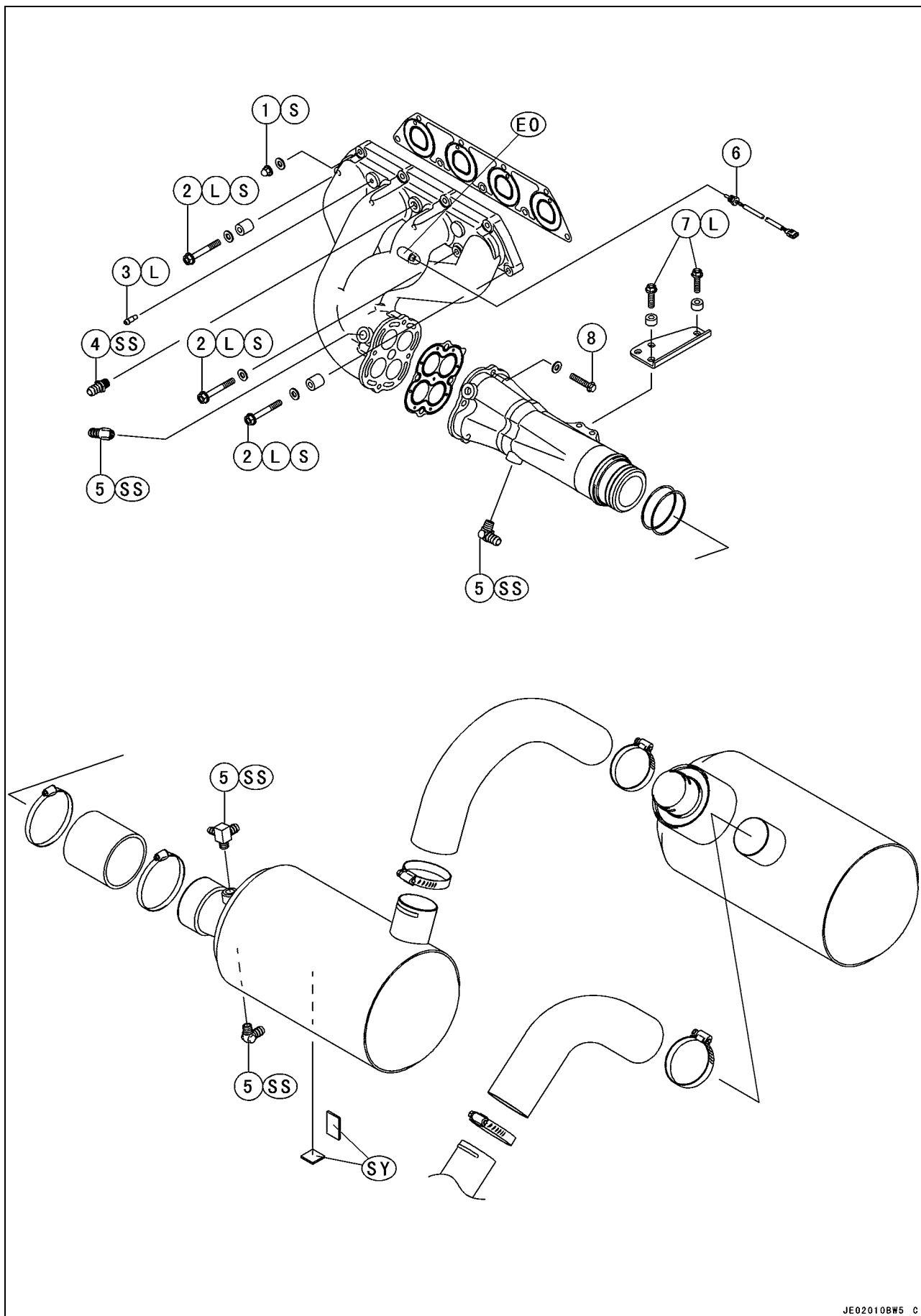
Exhaust System

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5-2 EXHAUST SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Exhaust Manifold Mounting Nuts	25	2.5	18	S
2	Exhaust Manifold Mounting Bolts	25	2.5	18	L, S
3	Bypass Nozzle	–	–	–	L
4	Flushing Hose Joint	11	1.1	95 in·lb	SS
5	Water Hose Joint	11	1.1	95 in·lb	SS
6	Water Temperature Sensor	15	1.5	11	see chapter 3
7	Exhaust Pipe Mounting Plate Bolts	30	3.0	22	L
8	Exhaust Pipe Mounting Bolts	30	3.0	22	

EO: Fill the hollow with the engine oil (10W-30).

L: Apply a non-permanent locking agent.

S: Follow the specific tightening sequence.

SS: Apply silicone sealant.

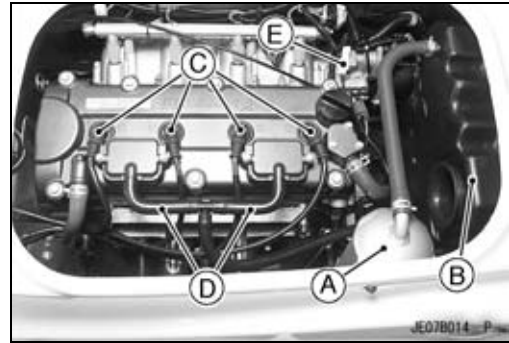
SY: Apply synthetic rubber adhesive.

5-4 EXHAUST SYSTEM

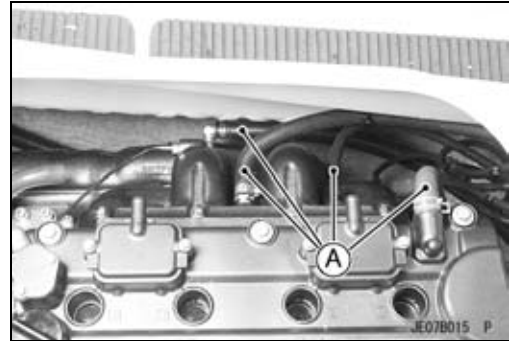
Exhaust Manifold

Exhaust Manifold Removal

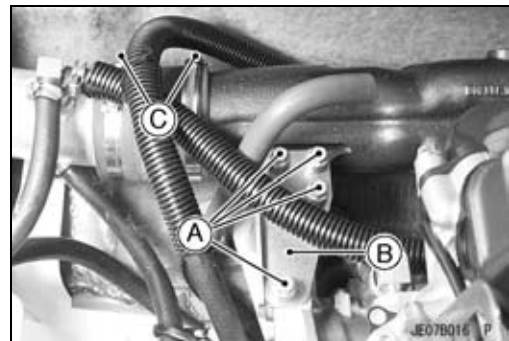
- Remove:
 - Oil Separator Tank [A] with the Oil Separator Hoses (see Lubrication system)
 - Air Filter [B] (see Fuel System chapter)
- Disconnect:
 - Spark Plug Caps [C] (see Periodic Maintenance chapter)
 - Hoses [D]
 - Water Temperature Sensor Connector [E]



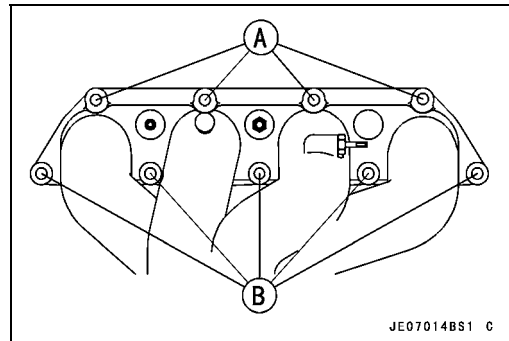
- Disconnect:
 - Hoses [A]



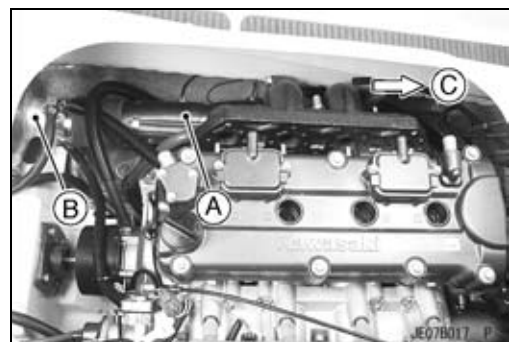
- Remove:
 - Bolts [A] and Collars
 - Exhaust Pipe Mounting Plate [B]
- Loosen:
 - Joint Tube Clamp Screws [C]



- Remove the exhaust manifold mounting nuts [A] and bolts [B].
- Remove the exhaust manifold from the engine.

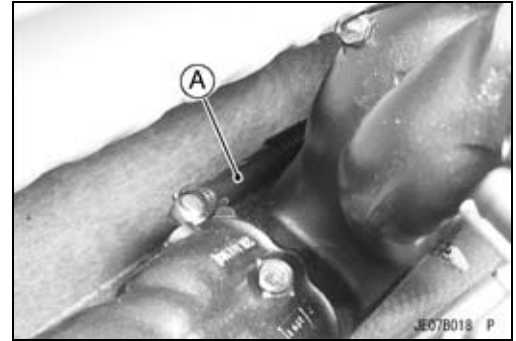


- Disconnect the exhaust pipe [A] from the left water box muffler [B] by pulling the exhaust manifold with the exhaust pipe toward the front [C].



Exhaust Manifold

- Take out the exhaust manifold with the exhaust pipe from the hull.
- Disconnect the hose [A] from the exhaust pipe.

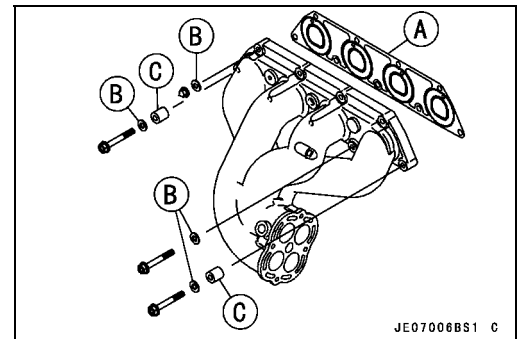


Exhaust Manifold Installation

NOTE

○ Unhook the rubber strap and remove the front exhaust tube from the water box muffler for easier installation of the exhaust manifold, and after connecting the water box muffler to the exhaust pipe, hook the rubber strap and install the tube.

- Replace the exhaust manifold gasket [A] with a new one.
- Install the exhaust manifold and the washers [B] and collars [C] as shown.
- Apply a non-permanent locking agent to the exhaust manifold mounting bolts.



- Tighten the exhaust manifold mounting nuts and bolts following the specified tightening sequence.

Torque - Exhaust Manifold Mounting Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)

Exhaust Manifold Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)

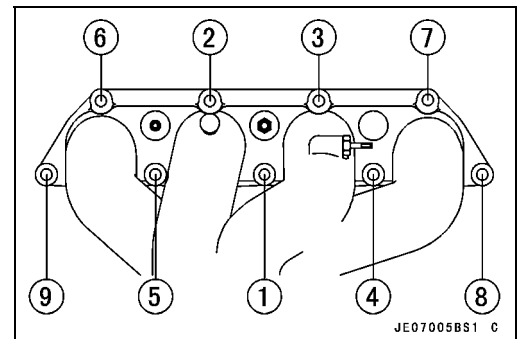
- Apply a non-permanent locking agent to the exhaust pipe mounting plate bolts and install the collars.
- Tighten:

Torque - Exhaust Pipe Mounting Plate Bolts: 30 N·m (3.0 kgf·m, 22 ft·lb)

- Connect the water box muffler to the exhaust pipe after binding the two rings with the paper tape (see Exhaust Pipe Installation).

★ If the water temperature sensor is removed, see water temperature sensor removal/installation in Fuel System chapter.

- Check the hose routing and clamp screw position (see Cable, Wire and Hose Routing in Appendix chapter).



5-6 EXHAUST SYSTEM

Exhaust Manifold

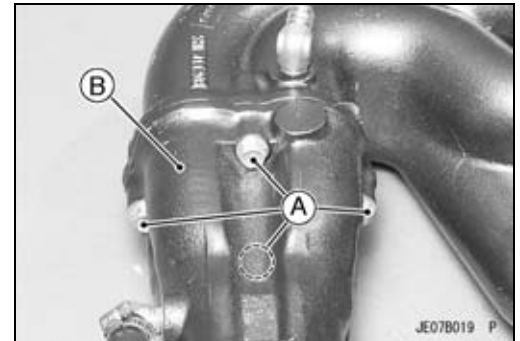
Exhaust Manifold Cleaning and Inspection

- Remove the exhaust manifold parts.
- Clean the carbon deposits out of the exhaust passages with a blunt, roundedged tool.
- Flush foreign matter out of the water passages with fresh water.
- Check the insides of the water passages for corrosion. Check the gasket surfaces for nicks or other damage.
- ★ If there is excessive corrosion or if the gasket surfaces are so badly damaged that they will not seal properly, replace the part.

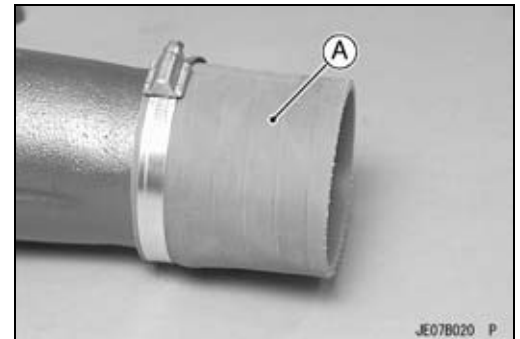
Exhaust Pipe

Exhaust Pipe Removal

- Remove:
 - Exhaust Manifold with Exhaust Pipe (see Exhaust Manifold Removal)
 - Exhaust Pipe Mounting Bolts [A]
 - Exhaust Pipe [B]

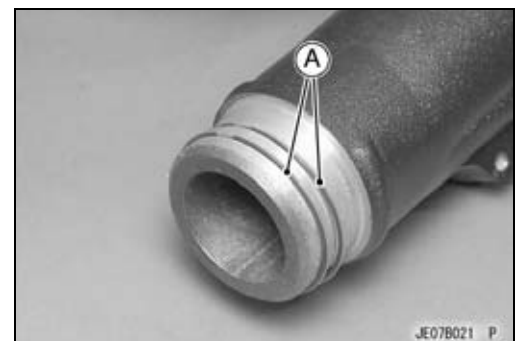


- Remove the joint tube [A] and the two rings.

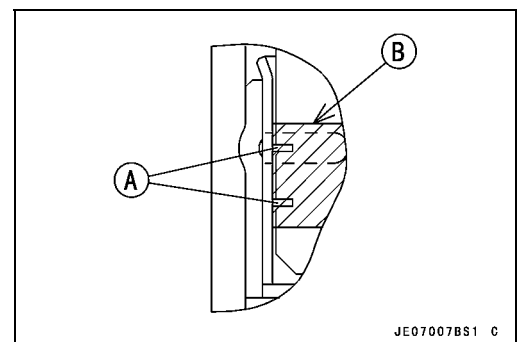


Exhaust Pipe Installation

- Install the two rings [A] in the ring grooves of the exhaust pipe.
- ★ If the two rings are damaged or warped, replace the rings.



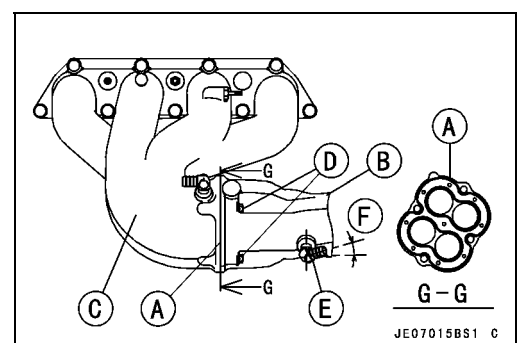
- Bind the two rings [A] securely by putting the paper tape [B] around the rings so that it is easy to insert the water box muffler into the exhaust pipe. The paper tape can be burned out soon after firing.
- Install the joint tube to the exhaust pipe.



- Replace the exhaust pipe gasket [A] with a new one as shown.
- Install the exhaust pipe [B] to the exhaust manifold [C] and tighten the bolts [D].

Torque - Exhaust Pipe Mounting Bolts: 30 N·m (3.0 kgf·m, 22 ft·lb)

- [E] Water Pipe Joint
- [F] 30°



5-8 EXHAUST SYSTEM

Exhaust Pipe

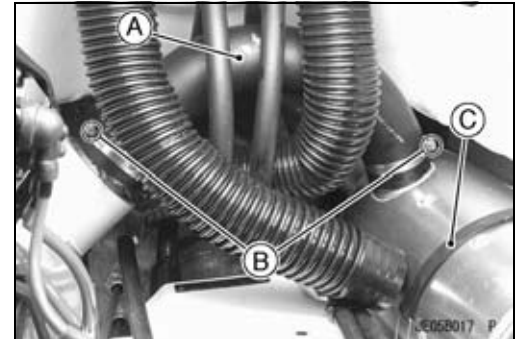
Exhaust Pipe Cleaning and Inspection

- Remove the exhaust pipe parts.
- Clean the carbon deposits out of the exhaust passages with a blunt, roundedged tool.
- Flush foreign matter out of the water passages with fresh water.
- Check the insides of the water passage for corrosion.
- Check the gasket surface for nicks or other damage.
- ★ If there is excessive corrosion or if the gasket surfaces are so badly damaged that they will not seal properly, replace the part.

Water Box Muffler

Water Box Muffler Removal

- Remove:
 - Rear Storage Pocket
 - Oil Separator Tank with Oil Separator Hoses (see the Lubrication System chapter)
 - Air Filter (see the Fuel System chapter)
- Loosen:
 - Joint Tube Clamp Screw (see Exhaust Manifold Removal)
- Remove the front exhaust tube [A] by loosening the clamp screws [B].
- Unhook the rubber strap [C] from the left water box muffler.



- Remove:
 - Hoses [A]
 - Exhaust Manifold [B] (see Exhaust Manifold Removal)



- Remove the left water box muffler by pulling it to the rear.

NOTE

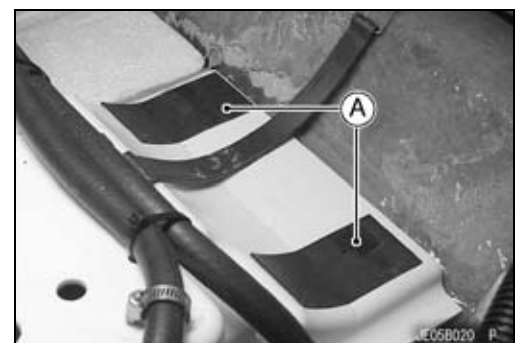
- When removing the left water box muffler, remove the water box muffler [A] from the deck with turning it with the welding spot [B] and rivets [C].
- Only left side water box muffler should be removed or inspected.

- Remove the joint tube from the exhaust pipe.



Water Box Muffler Installation

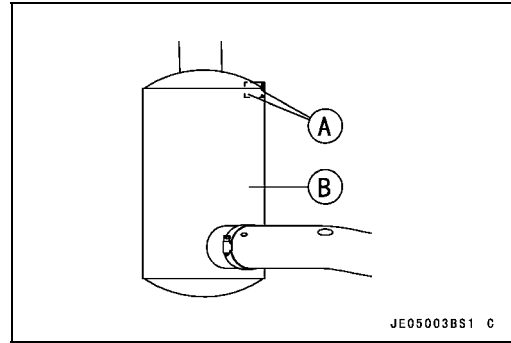
- Be sure the dampers [A] on the hull bottom and muffler body are in place.



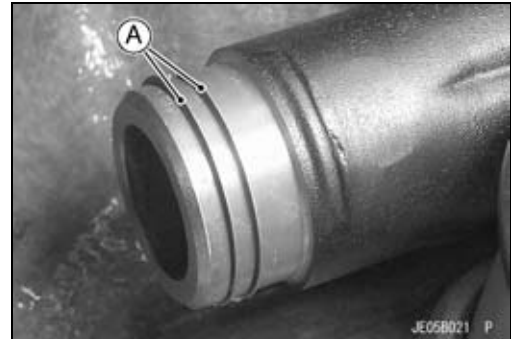
5-10 EXHAUST SYSTEM

Water Box Muffler

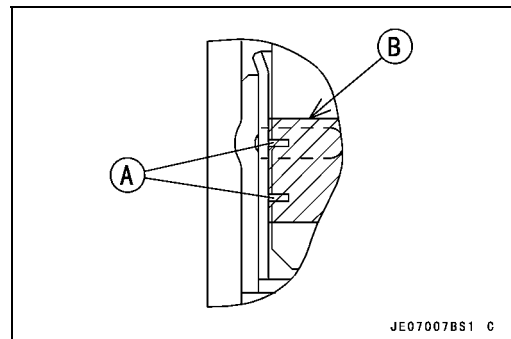
- Be sure the dampers [A] on the left side water box muffler [B] are in place.



- Make sure the two rings [A] are installed to the correct position.
- ★ If the rings are damaged or warped, replace the rings with new ones.



- Bind the two rings [A] by putting the paper tape [B] around the rings. The paper tape can be burned out soon after firing.



- Install the joint tube to the exhaust pipe.
- Install the left water box muffler to the exhaust pipe.
- Tighten the clamp securing the front exhaust tube, noting its screw position, and check the hose routing and clamp screw position (see Cable, Wire and Hose Routing in Appendix chapter).

Water Box Muffler Inspection

- Remove the left water box muffler.
- Empty water out of the water box.
- Check the inlet spigot for damage caused by excessive heat.
- ★ If there is heat damage to the inlet spigot, check the cooling system for blockage (see Cooling System Cleaning and Inspection) and the fuel system for proper adjustment (see Fuel System chapter).

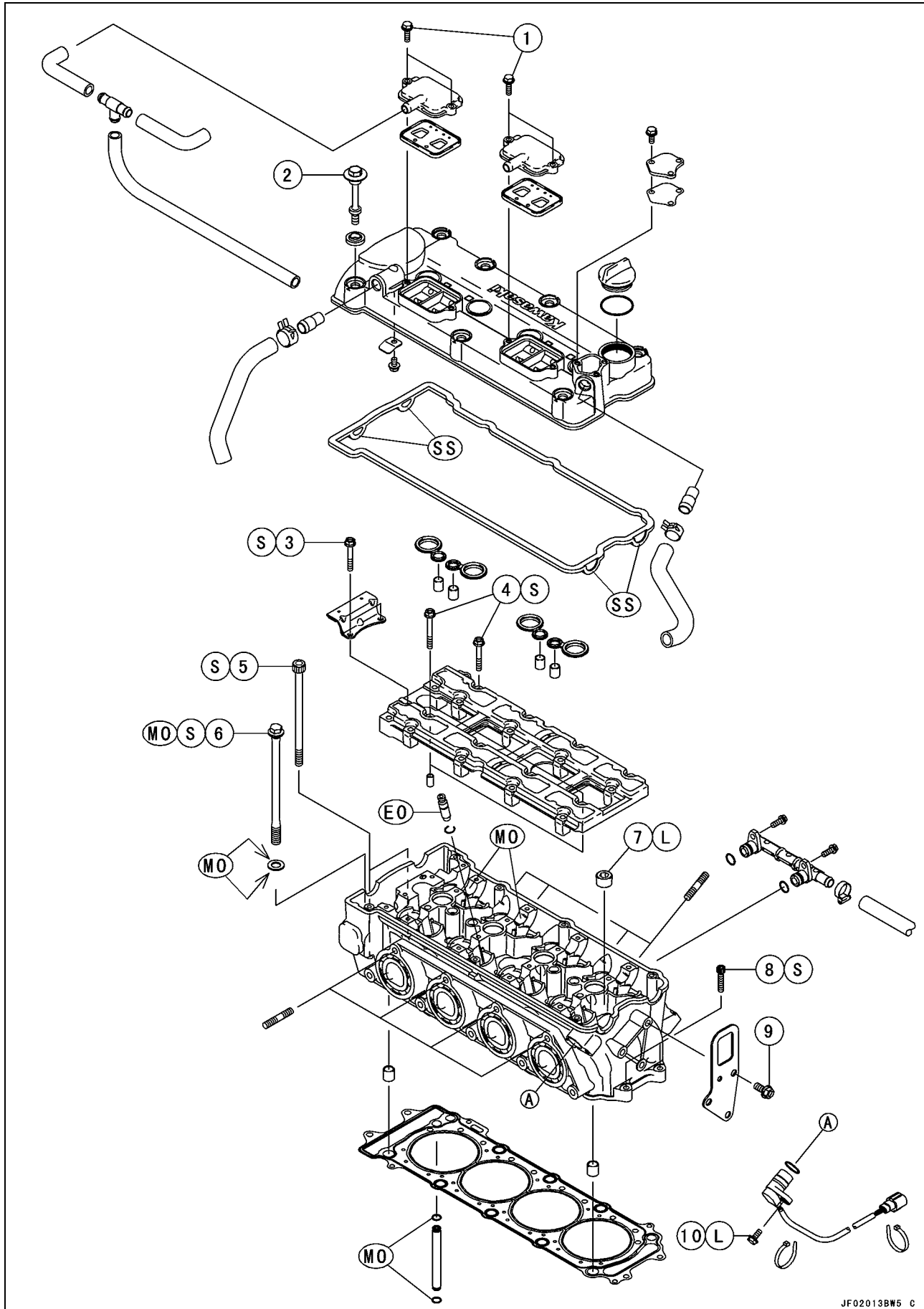
Engine Top End

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6-2 ENGINE TOP END

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Air Suction Valve Cover Bolts	9.8	1.0	87 in·lb	
2	Cylinder Head Cover Bolts	9.8	1.0	87 in·lb	
3	Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
4	Camshaft Cap Bolts	12	1.2	104 in·lb	S
5	Cylinder Head Bolts ($\phi 7$)	20	2.0	14	S
6	Cylinder Head Bolts ($\phi 11$)	23	2.3	17	First, MO, S
6	Cylinder Head Bolts ($\phi 11$)	59	6.0	43	Final, MO, S
7	Water Jacket Plugs	20	2.0	14	L
8	Cylinder Head Bolts ($\phi 6$)	12	1.2	104 in·lb	S
9	Engine Hook Bolts	20	2.0	14	
10	Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L

EO: Apply engine oil.

L: Apply a non-permanent locking agent.

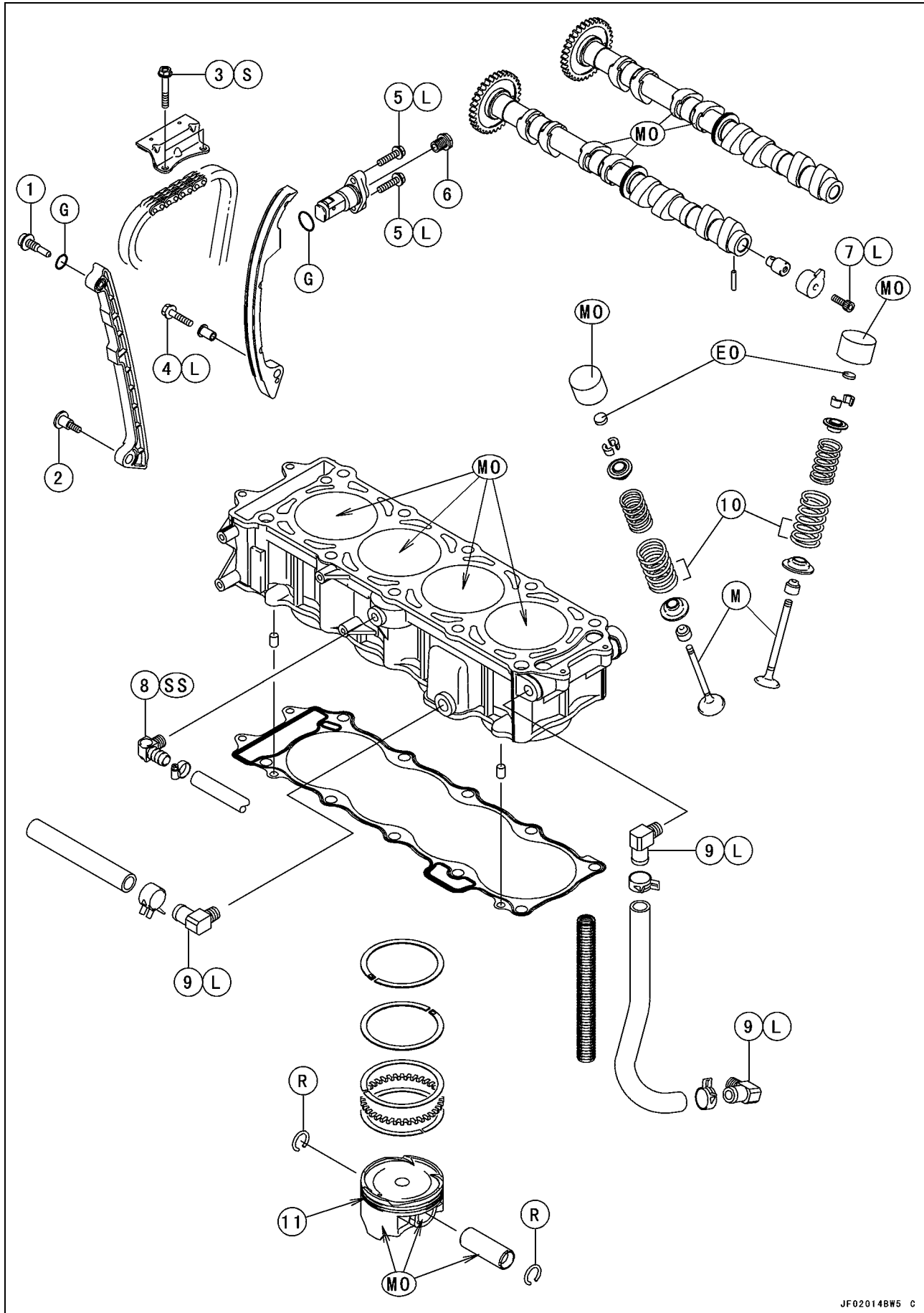
MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).

S: Follow the specific tightening sequence.

SS: Apply silicone sealant.

6-4 ENGINE TOP END

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Exhaust Side Camshaft Chain Guide Bolts (Upper)	25	2.5	18	
2	Exhaust Side Camshaft Chain Guide Bolts (Lower)	12	1.2	104 in·lb	
3	Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
4	Inlet Side Camshaft Chain Guide Bolt	12	1.2	104 in·lb	L
5	Camshaft Chain Tensioner Mounting Bolts	9.8	1.0	87 in·lb	L
6	Camshaft Chain Tensioner Cap Bolt	20	2.0	14	
7	Camshaft Position Sensor Rotor Bolt	12	1.2	104 in·lb	L
8	Water Hose Joint	11	1.1	95 in·lb	SS
9	Oil Passage Joint	11	1.1	95 in·lb	L

10. Closed coil end faces downward.

11. A marking hollow faces exhaust side.

EO: Apply engine oil.

G: Apply grease.

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).

R: Replacement Parts

S: Follow the specific tightening sequence.

SS: Apply silicon sealant.

6-6 ENGINE TOP END

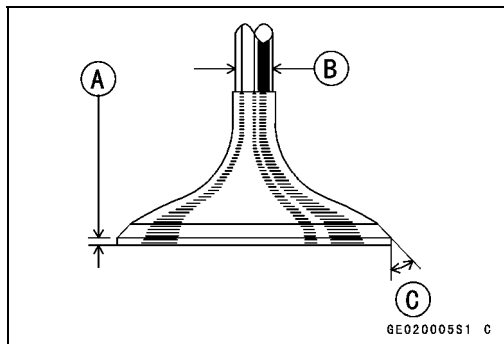
Specifications

Item	Standard	Service Limit
Camshafts		
Cam Height:		
Exhaust	36.143 ~ 36.257 mm (1.4229 ~ 1.4274 in.)	36.04 mm (1.4189 in.)
Inlet	36.440 ~ 36.554 mm (1.4346 ~ 1.4391 in.)	36.34 mm (1.431 in.)
Camshaft Journal, Camshaft Cap Clearance	0.028 ~ 0.071 mm (0.0011 ~ 0.0028 in.)	0.16 mm (0.006 in.)
Camshaft Journal Diameter	23.950 ~ 23.972 mm (0.9429 ~ 0.9438 in.)	23.92 mm (0.942 in.)
Camshaft Bearing Inside Diameter	24.000 ~ 24.021 mm (0.9449 ~ 0.9457 in.)	24.08 mm (0.948 in.)
Camshaft Runout	TIR 0.02 mm (0.0008 in.) or less	TIR 0.1 mm (0.004 in.)
Cylinder Head		
Cylinder Compression	(usable range) 1 185~ 1 795 kPa (12.1 ~ 18.3 kgf/cm ² , 172 ~ 260 psi) @430 r/min. (rpm)	— — —
Cylinder Head Warp	— — —	0.05 mm (0.002 in.)
Valves		
Valve Clearance:		
Exhaust	0.22 ~ 0.31 mm (0.0087 ~ 0.0122 in.)	— — —
Inlet	0.15 ~ 0.24 mm (0.0059 ~ 0.0094 in.)	— — —
Valve Head Thickness:		
Exhaust	0.8 mm (0.03 in.)	0.5 mm (0.02 in.)
Inlet	0.5 mm (0.02 in.)	0.25 mm (0.0098 in.)
Valve Stem Bend	TIR 0.01 mm (0.0004 in.) or less	TIR 0.05 mm (0.002 in.)
Valve Stem Diameter:		
Exhaust	4.955 ~ 4.970 mm (0.1951 ~ 0.1957 in.)	4.94 mm (0.194 in.)
Inlet	4.975 ~ 4.990 mm (0.1959 ~ 0.1965 in.)	4.96 mm (0.195 in.)
Valve Guide Inside Diameter:		
Exhaust	5.000 ~ 5.012 mm (0.1969 ~ 0.1973 in.)	5.07 mm (0.200 in.)
Inlet	5.000 ~ 5.012 mm (0.1969 ~ 0.1973 in.)	5.07 mm (0.200 in.)
Valve/valve Guide Clearance (Wobble Method):		
Exhaust	0.09 ~ 0.17 mm (0.0035 ~ 0.0067 in.)	0.35 mm (0.014 in.)
Inlet	0.03 ~ 0.11 mm (0.0012 ~ 0.0043 in.)	0.29 mm (0.011 in.)
Valve Seat Cutting Angle	45°, 32°, 60°, 55°	— — —
Valve Seating Surface:		
Outside Diameter:		
Exhaust	27.6 ~ 27.8 mm (1.087 ~ 1.094 in.)	— — —
Inlet	32.6 ~ 32.8 mm (1.283 ~ 1.291 in.)	— — —
Width:		
Exhaust	0.8 ~ 1.2 mm (0.03 ~ 0.047 in.)	— — —
Inlet	0.5 ~ 1.0 mm (0.02 ~ 0.039 in.)	— — —
Valve Spring Free Length:		
Exhaust (Inner)	38.08 mm (1.499 in.)	36.7 mm (1.445 in.)
Exhaust (Outer)	45.97 mm (1.810 in.)	44.3 mm (1.744 in.)
Inlet (Inner)	37.97 mm (1.495 in.)	36.5 mm (1.437 in.)

Specifications

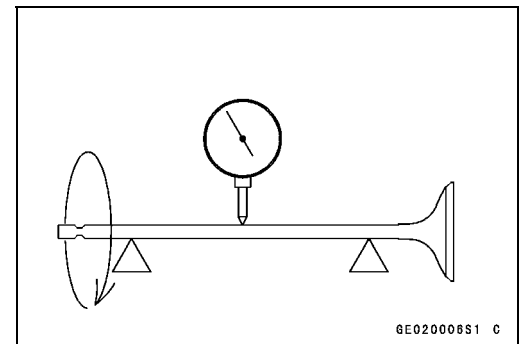
Item	Standard	Service Limit
Inlet (Outer)	45.78 mm (1.802 in.)	44.2 mm (1.740 in.)
Cylinder, Piston		
Cylinder Inside Diameter	82.994 ~ 83.006 mm (3.2675 ~ 3.2679 in.)	83.10 mm (3.272 in.)
Piston Diameter	82.919 ~ 82.934 mm (3.2645 ~ 3.2651 in.)	82.77 mm (3.259 in.)
Piston/cylinder Clearance	0.060 ~ 0.087 mm (0.0024 ~ 0.0034 in.)	---
Piston Ring/groove Clearance:		
Top	0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)	0.17 mm (0.0067 in.)
Second	0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in.)	0.16 mm (0.0063 in.)
Piston Ring Groove Width:		
Top	0.92 ~ 0.94 mm (0.0362 ~ 0.0370 in.)	1.02 mm (0.0402 in.)
Second	1.01 ~ 1.03 mm (0.0398 ~ 0.0406 in.)	1.11 mm (0.0437 in.)
Piston Ring Thickness:		
Top	0.87 ~ 0.89 mm (0.0343 ~ 0.0350 in.)	0.80 mm (0.0315 in.)
Second	0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)	0.90 mm (0.0354 in.)
Piston Ring End Gap:		
Top	0.25 ~ 0.40 mm (0.0098 ~ 0.0157 in.)	0.7 mm (0.0276 in.)
Second	0.40 ~ 0.55 mm (0.0157 ~ 0.0217 in.)	0.8 mm (0.0315 in.)

Valve Head Thickness



Valve Head Thickness [A]
 Valve Stem Diameter [B]
 45° [C]

Valve Stem Bend



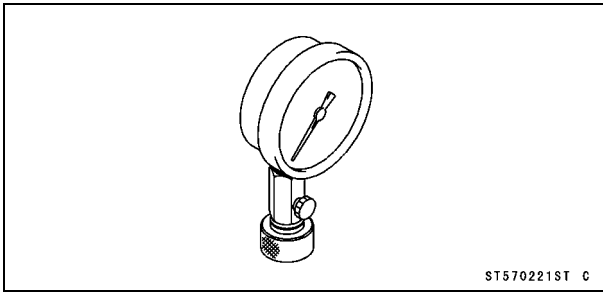
GE020006S1 C

6-8 ENGINE TOP END

Special Tools and Sealant

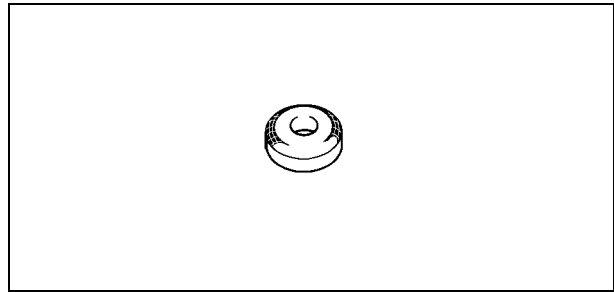
Compression Gauge, 20 kgf/cm²:

57001-221



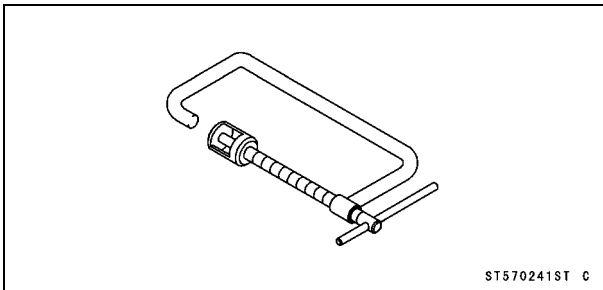
Valve Seat Cutter, 45° - ϕ 35:

57001-1116



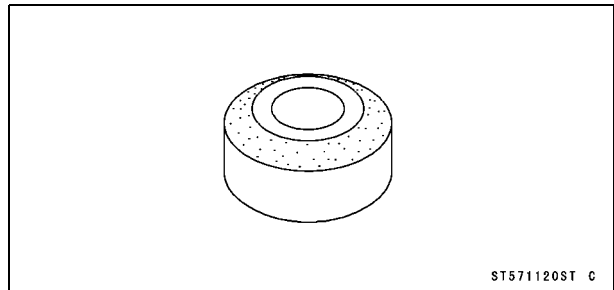
Valve Spring Compressor Assembly:

57001-241



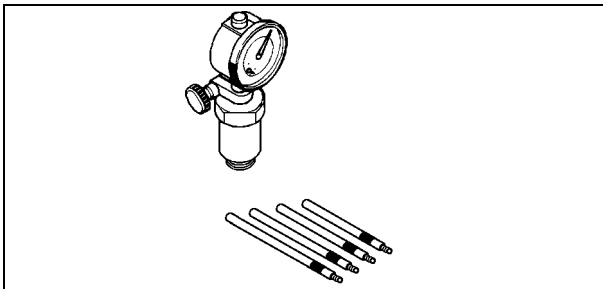
Valve Seat Cutter, 32° - ϕ 30:

57001-1120



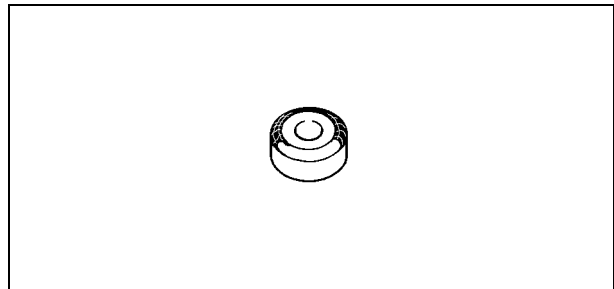
Top Dead Center Finder:

57001-402



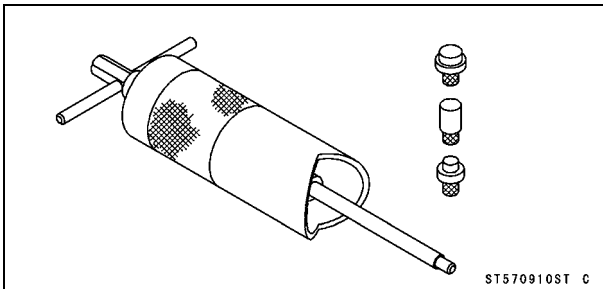
Valve Seat Cutter, 32° - ϕ 35:

57001-1121



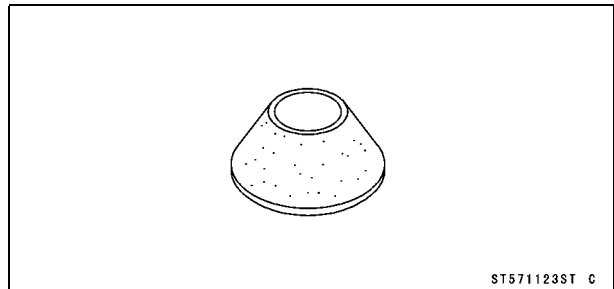
Piston Pin Puller Assembly:

57001-910



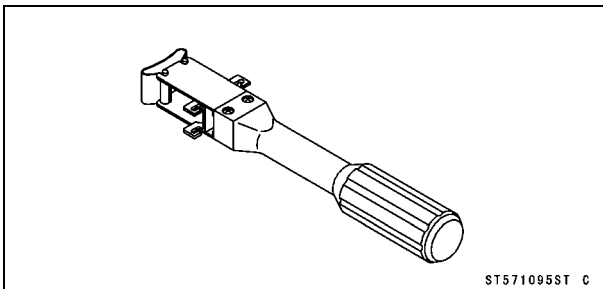
Valve Seat Cutter, 60° - ϕ 30:

57001-1123



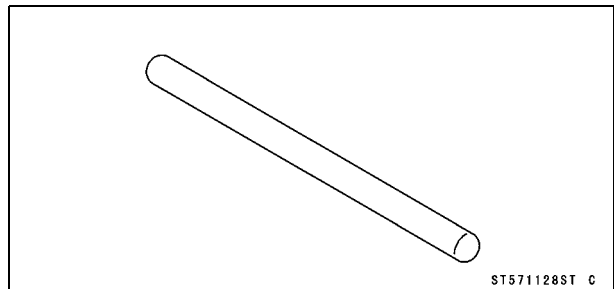
Piston Ring Compressor Grip:

57001-1095



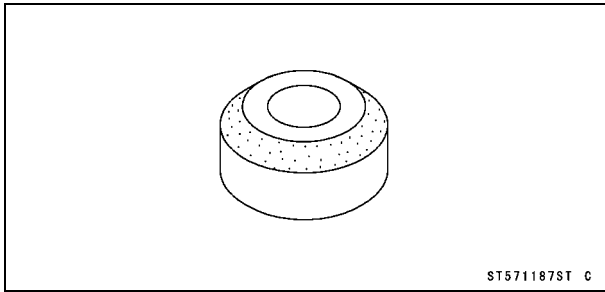
Valve Seat Cutter Holder Bar:

57001-1128

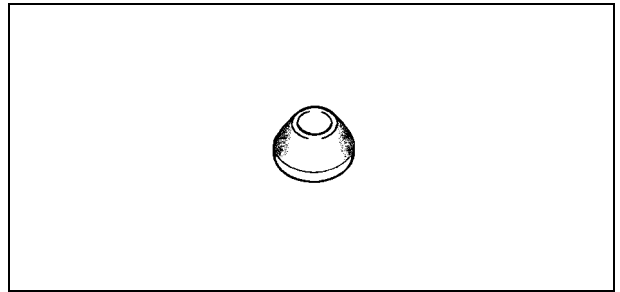


Special Tools and Sealant

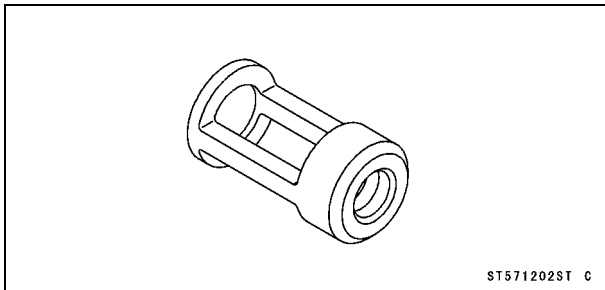
Valve Seat Cutter, 45° - $\phi 30$:
57001-1187



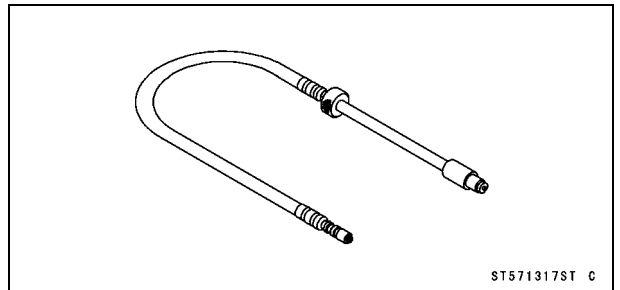
Valve Seat Cutter, 55° - $\phi 35$:
57001-1247



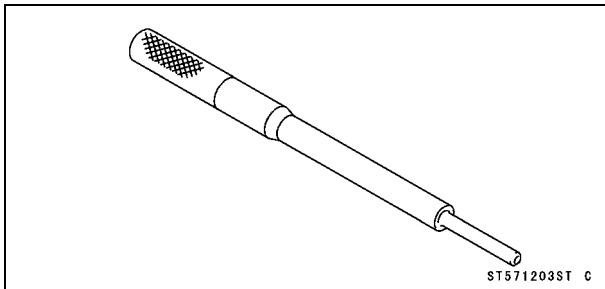
Valve Spring Compressor Adapter, $\phi 22$:
57001-1202



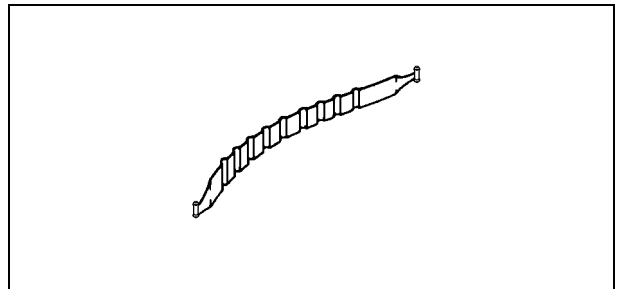
Compression Gauge Adapter, M10 × 1.0:
57001-1317



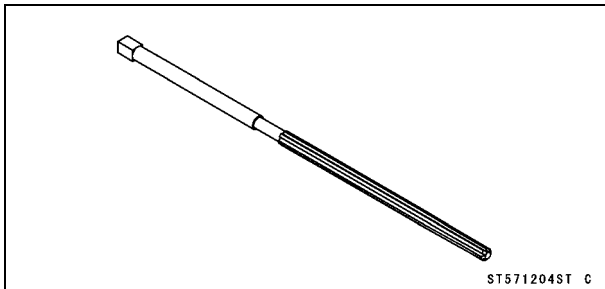
Valve Guide Arbor, $\phi 5$:
57001-1203



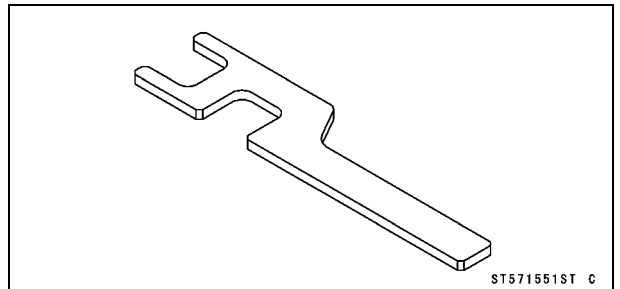
Piston Ring Compressor Belt, $\phi 80 \sim \phi 91$:
57001-1320



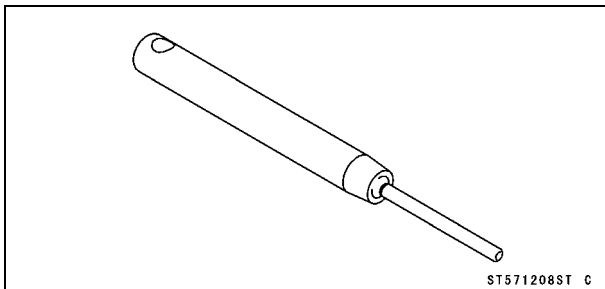
Valve Guide Reamer, $\phi 5$:
57001-1204



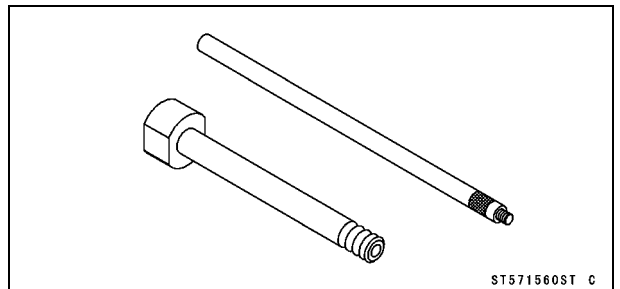
Shaft Wrench:
57001-1551



Valve Seat Cutter Holder, $\phi 5$:
57001-1208



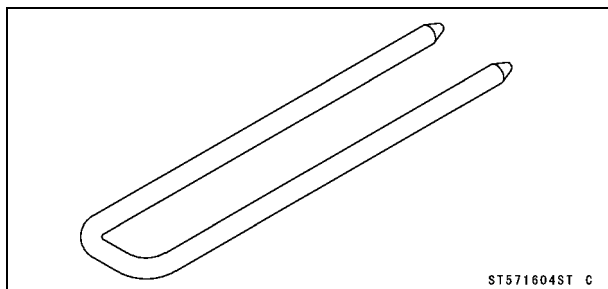
TDC Measurement Tool:
57001-1560



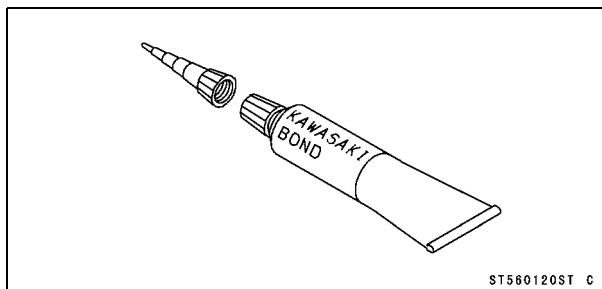
6-10 ENGINE TOP END

Special Tools and Sealant

Piston Base, $\phi 8$:
57001-1604



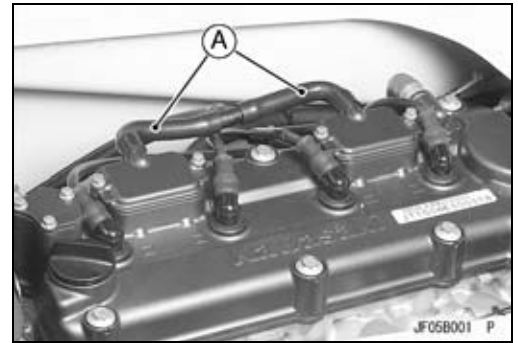
Kawasaki Bond (Silicone Sealant):
56019-120



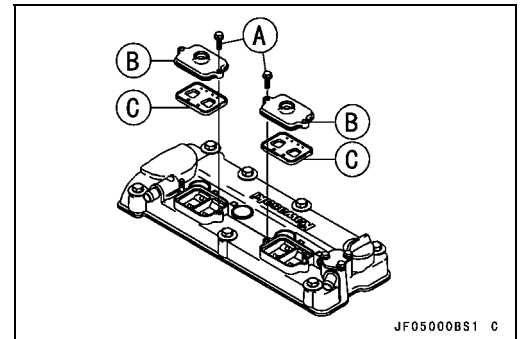
Clean Air System

Air Suction Valve Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Hoses [A]



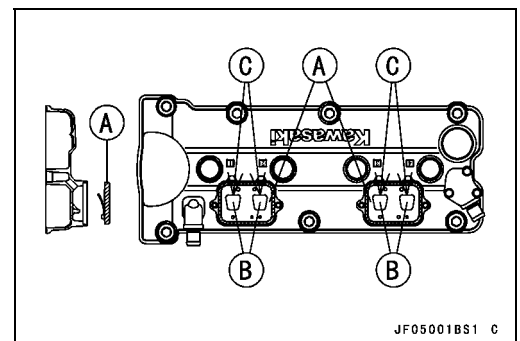
- Remove:
 - Air Suction Valve Cover Bolts [A]
 - Air Suction Valve Covers [B]
 - Air Suction Valve Assembly [C]



Air Suction Valve Installation

- Install the valve assembly [A] so that its reeds [B] side faces inside and its opening [C] side faces inlet side.
- Install the air suction valve covers.

Torque - Air Suction Valve Cover Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



Air Suction Valve Check

- Refer to Air Suction Valve in the Periodic Maintenance chapter.

Clean Air System Hose Inspection

- Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly to the air filter housing, throttle body and air suction valve covers.
- ★ If they are not, correct them. Replace them if they are damaged.

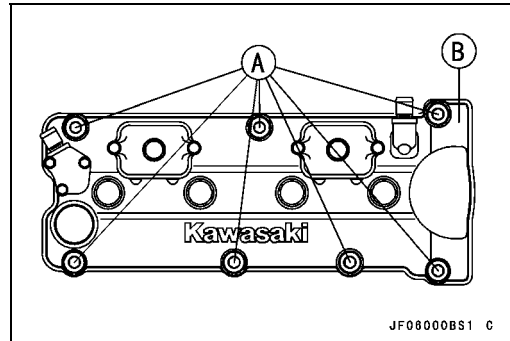
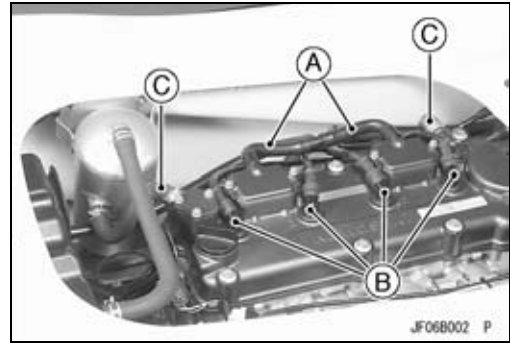
6-12 ENGINE TOP END

Cylinder Head Cover

Cylinder Head Cover Removal

- Remove:
 - Air Suction Valve Hoses [A]
 - Spark Plug Caps [B]
 - Breather Hoses [C]

- Remove the cylinder head cover bolts [A] and take off the cover [B].

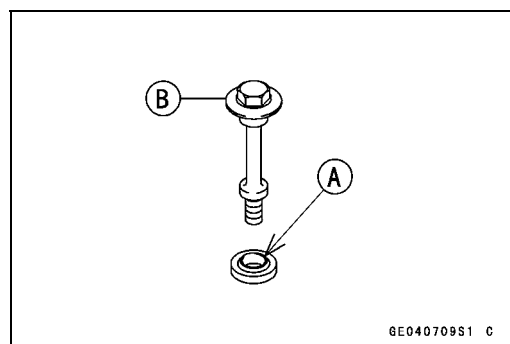
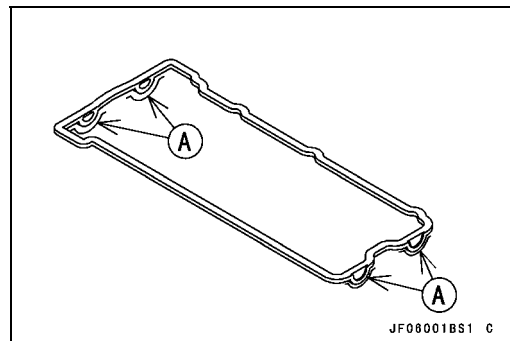
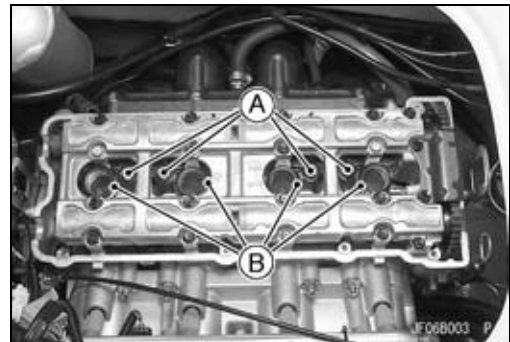


Cylinder Head Cover Installation

- Be sure to install the pins [A] and rubber gaskets [B].

- Replace the head cover gasket with a new one if damaged.
- Apply silicone sealant [A] to the cylinder head cover gasket as shown.
Sealant - Kawasaki Bond (Silicone Sealant): 56019-120

- Install the washer with the metal side [A] faces upward.
- Tighten:
Torque - Cylinder Head Cover Bolts [B]: 9.8 N·m (1.0 kgf·m, 87 in·lb)
- Route the hoses correctly (see Appendix chapter).



Camshaft Chain Tensioner

Camshaft Chain Tensioner Removal

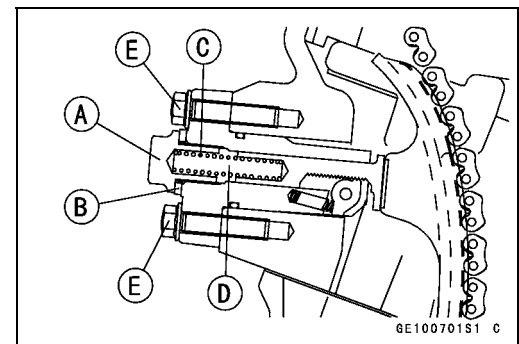
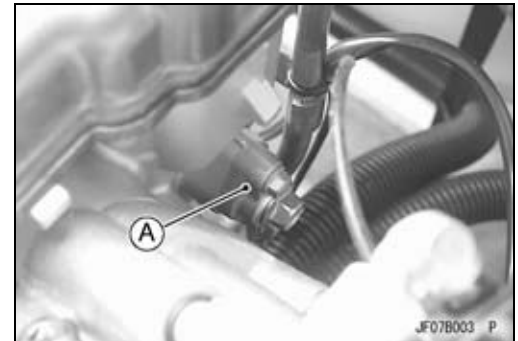
CAUTION

This is a non-return type camshaft chain tensioner [A]. The push rod does not return to its original position once it moves out to take up camshaft chain slack. Observe all the rules listed below:

When removing the tensioner, do not take out the mounting bolts only halfway. Retightening the mounting bolts from this position could damage the tensioner and the camshaft chain. Once the bolts are loosened, the tensioner must be removed and reset as described in "Camshaft Chain Tensioner installation."

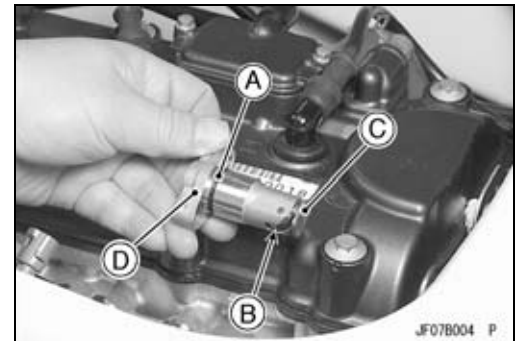
Do not turn over the crankshaft while the tensioner is removed. This could upset the camshaft chain timing, and damage the valves.

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Cap Bolt [A]
 - Washer [B]
 - Spring [C]
 - Rod [D]
- Remove the mounting bolts [E] and take off the camshaft chain tensioner.



Camshaft Chain Tensioner Installation

- Apply grease to the O-ring [A].
- Release the stopper [B] and push the push rod [C] into the tensioner body [D] fully.
- Install the tensioner body so that the stopper faces downward.

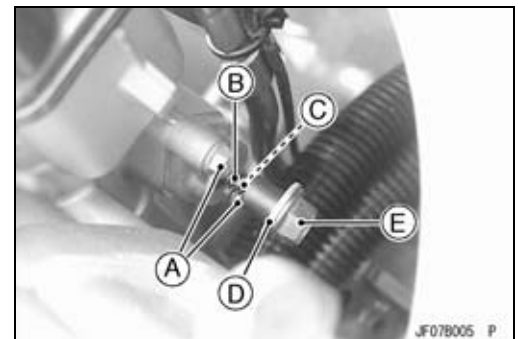


- Apply a non-permanent locking agent to the tensioner mounting bolts [A].
- Tighten the tensioner mounting bolts.

Torque - Camshaft Chain Tensioner Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Install the spring [B], rod [C] and washer [D].
- Tighten the cap bolt [E].

Torque - Camshaft Chain Tensioner Cap Bolt: 20 N·m (2.0 kgf·m, 14 ft·lb)

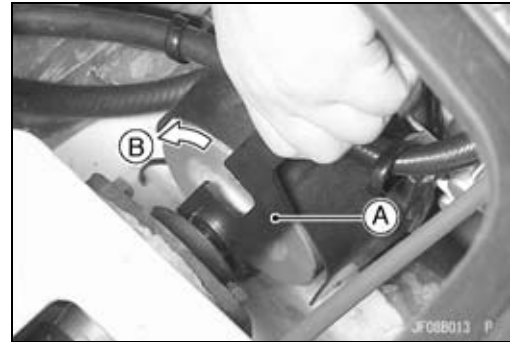


6-14 ENGINE TOP END

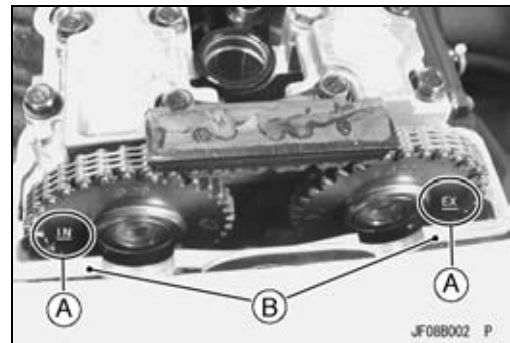
Camshaft, Camshaft Chain

Camshaft Removal

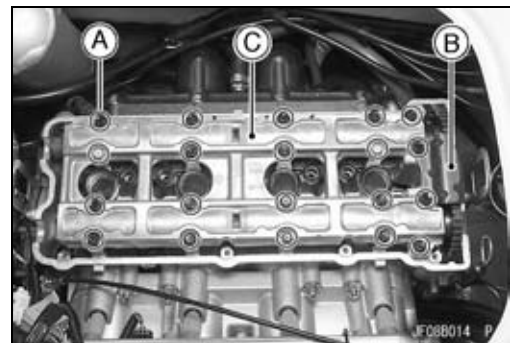
- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Spark Plugs (see Periodic Maintenance chapter)
 - Cylinder Head Cover (see Cylinder Head Cover Removal)
 - Air Filter (see Fuel System (DFI) chapter)
 - Position the crankshaft at #1, #4 piston TDC as follows.
 - Using the shaft wrench [A], turn the crankshaft counter-clockwise [B] and set the crankshaft at #1, 4 piston TDC.
- Special Tool - Shaft Wrench: 57001-1551**



- The timing marks [A] must be aligned with the cylinder head upper surface [B] as shown.



- Remove:
 - Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
 - Camshaft Cap Bolts [A]
 - Upper Camshaft Chain Guide [B]
 - Camshaft Cap [C]
 - Camshafts
- Stuff a clean cloth into the chain tunnel to keep any parts from dropping into the crankcase.



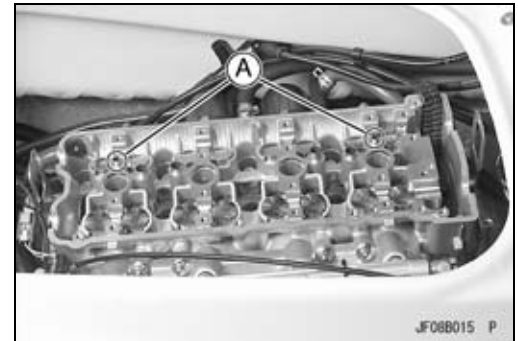
CAUTION

The crankshaft may be turned while the camshafts are removed. Always pull the chain taut while turning the crankshaft. This avoids kinking the chain on the lower (crankshaft) sprocket. A kinked chain could damage both the chain and the sprocket.

Camshaft, Camshaft Chain

Camshaft Installation

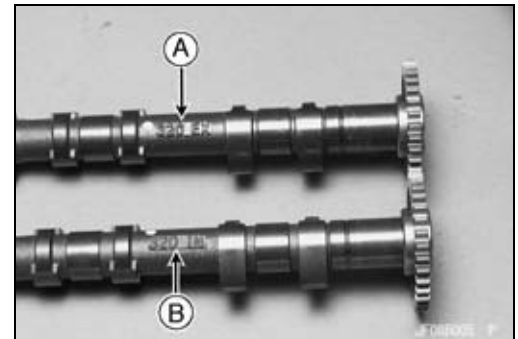
- Be sure to install the following parts.
Pins [A]



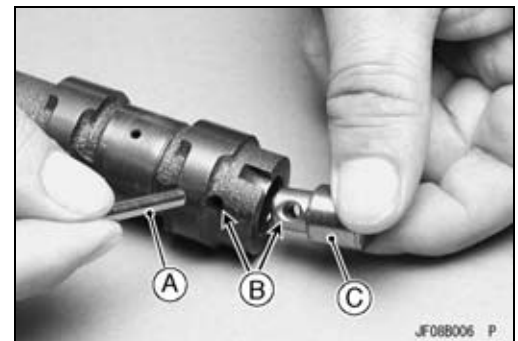
- Apply molybdenum disulfide oil solution to all cam parts and journals.

NOTE

- The exhaust camshaft has a 320 EX mark [A] and the inlet camshaft has a 320 IN mark [B]. Be careful not to mix up these shafts.

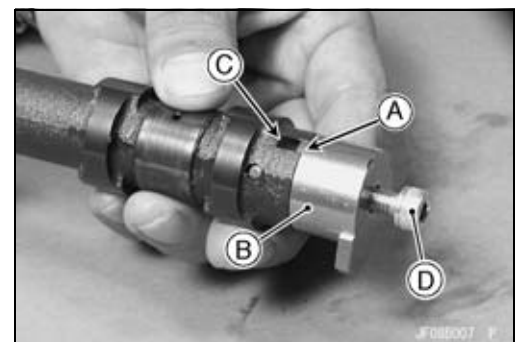


- ★ If the camshaft position sensor rotor is removed, install it as follows.
- Insert the pin [A] into the holes [B] in the camshaft and boss [C].

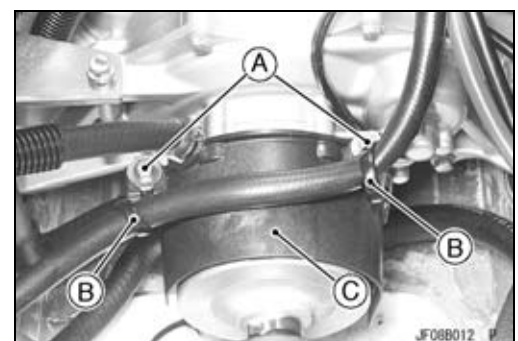


- Fit the projection [A] of the rotor [B] on the camshaft recess [C].
- Apply a non-permanent locking agent to the camshaft position sensor rotor bolt [D], and tighten it.

Torque - Camshaft Position Sensor Rotor Bolt: 12 N·m (1.2 kgf·m, 104 in·lb)



- Remove:
Coupling Cover Bolts [A]
Clamps [B]
Coupling Cover [C]

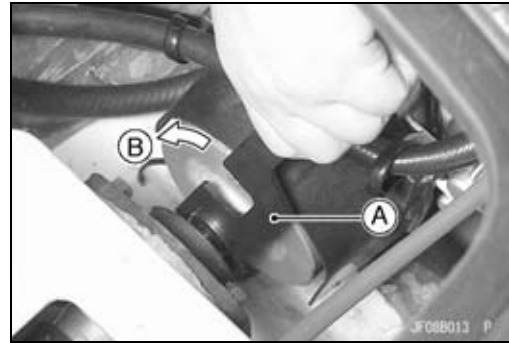


6-16 ENGINE TOP END

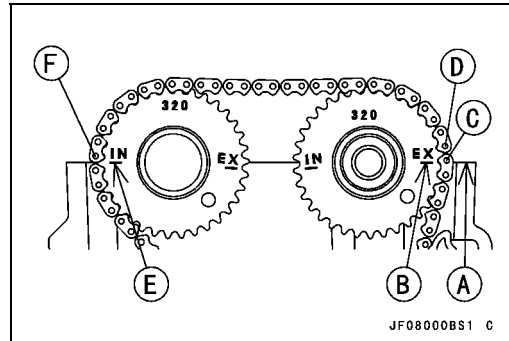
Camshaft, Camshaft Chain

- Remove the spark plugs.
- Using the shaft wrench [A], turn the crankshaft counterclockwise [B] and set the crankshaft at #1, 4 piston TDC (see Piston TDC Finding).

Special Tool - Shaft Wrench: 57001-1551



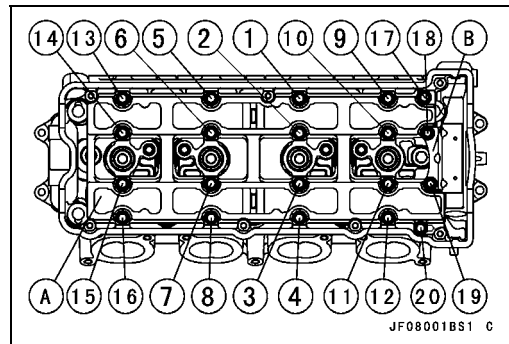
- Pull the tension side (exhaust side) of the chain taut to install the chain.
- Engage the camshaft chain with the camshaft sprockets so that the timing marks on the sprockets are positioned as shown.
- The timing marks must be aligned with the cylinder head upper surface [A].
 - EX mark [B]
 - #1 Pin [C]
 - #2 Pin [D]
 - IN mark [E]
 - #31 Pin [F]



- Install the camshaft cap [A] and upper camshaft chain guide [B]. While pushing the camshaft chain, tighten all camshaft bolts and chain guide bolts.
- Install the longer (white) bolts to the #10 and #14 position shown by triangle marks.
- First tighten the all camshaft cap and chain guide bolts evenly to seat the camshaft in place, then tighten all bolts following the specified tightening sequence.

Torque - Camshaft Cap Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)
Upper Camshaft Chain Guide Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)

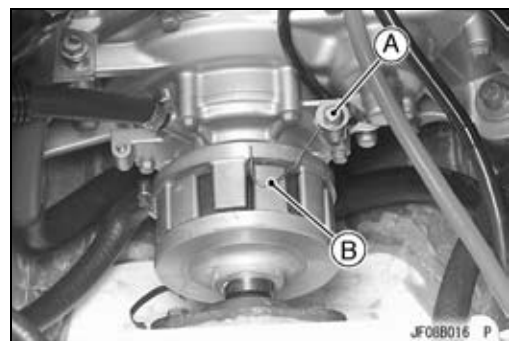
- Tighten the camshaft chain tensioner (see Camshaft Chain Tensioner installation).
- Turn the crankshaft counterclockwise two turns.
- Install the cylinder head cover (see Cylinder Head Cover installation).



Piston TDC Finding

This job can be done when the engine is on the hull and during camshaft installation.

- Prepare a suitable wire for pointer.
- Using the coupler cover bolt [A], hold the wire pointer [B].



Camshaft, Camshaft Chain

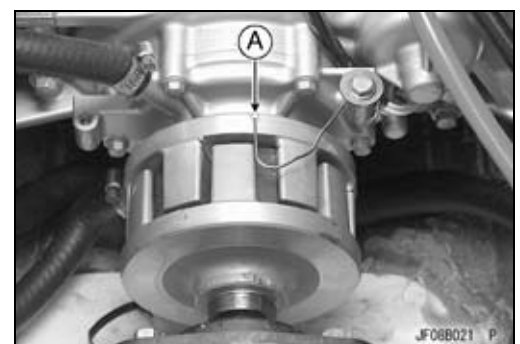
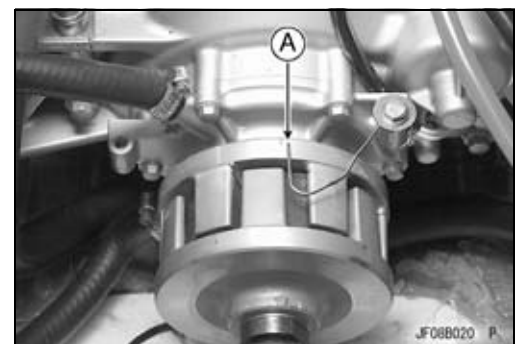
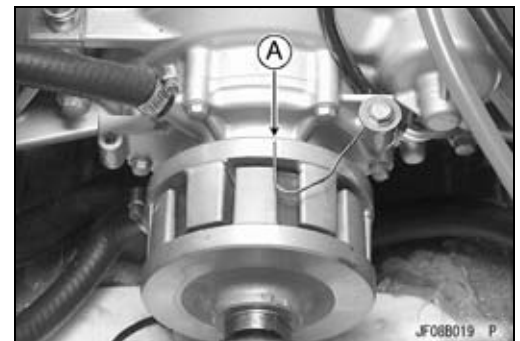
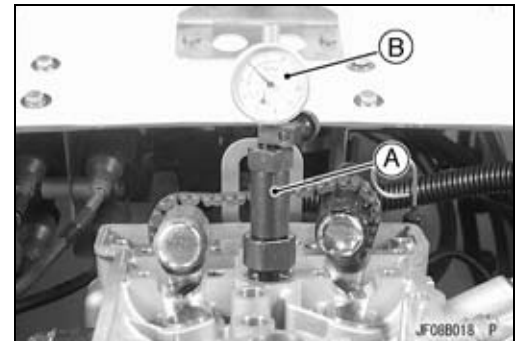
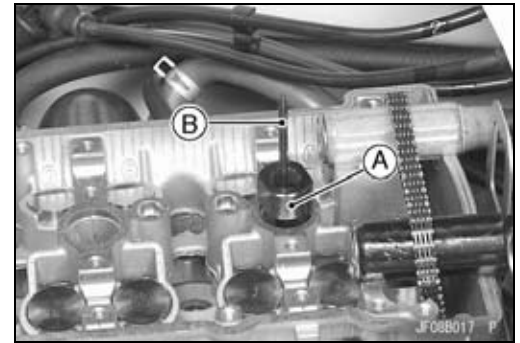
- Remove:
 - #1 Spark Plug (Front Side)
- Install the piston top detector [A] in the hole of the plug.
 - Special Tool - TDC Measurement Tool: 57001-1560**
- Insert the gauge extender [B] into the detector.
- Using the shaft wrench, turn the crankshaft until the gauge extender reaches its highest point.
 - Special Tool - Shaft Wrench: 57001-1551**
- Remove the extender and install it to the gauge.

- Install the top dead center finder [A] and the gauge [B] with the extender.
 - Special Tool - Top Dead Center Finder: 57001-402**
- Set the gauge at position that the needle on the gauge rotates a few turns.
- Set the gauge to read "0".

- Turn the crankshaft counterclockwise until the needle will stop fluctuating, then scribe a mark [A] on the coupling at the tip of the wire pointer.

- Turn the crankshaft clockwise until the needle will stop fluctuating, then describe a mark [A] on the coupling at the tip of the wire pointer.

- Turn the crankshaft so that the wire pointer is halfway [A] between the two described marks.
 - The crankshaft is now at TDC for #1 and #4 Cylinders.



6-18 ENGINE TOP END

Camshaft, Camshaft Chain

Camshaft, Camshaft Cap Wear

- Cut strips of plastigage (press gauge) to journal width. Place a strip on each journal parallel to the camshaft installed in the correct position.
- Measure each clearance between the camshaft journal and the camshaft cap using plastigage [A].
- Tighten:

Torque - Camshaft Cap Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)
Upper Camshaft Chain Guide Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)

NOTE

○ Do not turn the camshaft when the plastigage is between the journal and camshaft cap.

Camshaft Journal, Camshaft Cap Clearance

Standard: 0.028 ~ 0.071 mm (0.0011 ~ 0.0028 in.)

Service Limit: 0.16 mm (0.006 in.)

- ★ If any clearance exceeds the service limit, measure the diameter of each camshaft journal with a micrometer.

Camshaft Journal Diameter

Standard: 23.950 ~ 23.972 mm (0.9429 ~ 0.9438 in.)

Service Limit: 23.92 mm (0.942 in.)

- ★ If the camshaft journal diameter is less than the service limit, replace the camshaft with a new one and measure the clearance again
- ★ If the clearance still remains out of the limit, replace the cylinder head with camshaft cap.

Camshaft Runout

- Remove the camshaft (see Camshaft Removal).
- Set the camshaft on V blocks.
- Measure runout with a dial gauge at the specified place as shown.
- ★ If the runout exceeds the service limit, replace the camshaft.

Camshaft Runout

Standard: TIR 0.02 mm (0.0008 in.) or less

Service Limit: TIR 0.1 mm (0.004 in.)

Cam Wear

- Remove the camshaft (see Camshaft Removal).
- Measure the height [A] of each cam with a micrometer.
- ★ If the cams are worn down past the service limit, replace the camshaft.

Cam Height

Standard:

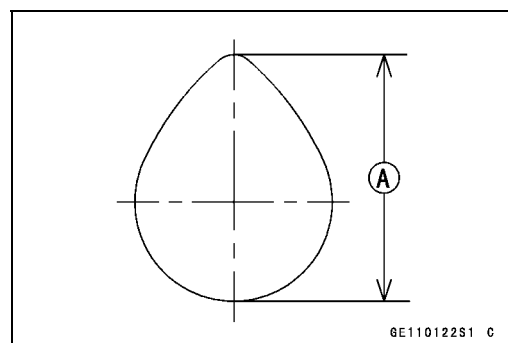
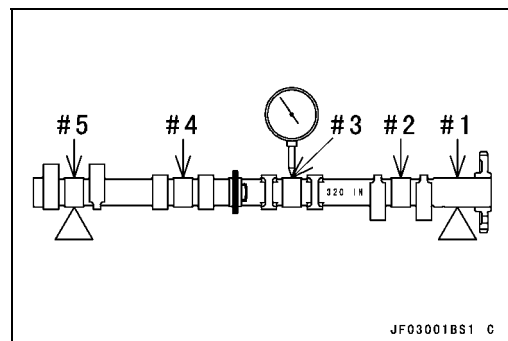
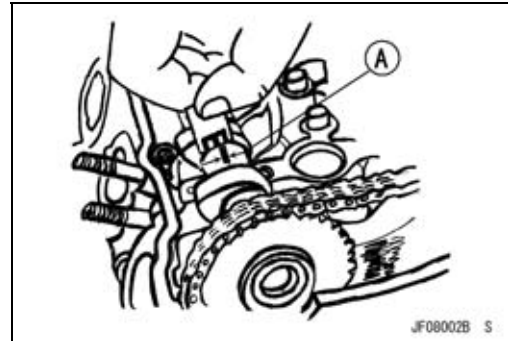
Exhaust 36.143 ~ 36.257 mm (1.4229 ~ 1.4274 in.)

Inlet 36.440 ~ 36.554 mm (1.4346 ~ 1.4391 in.)

Service Limit:

Exhaust 36.04 mm (1.419 in.)

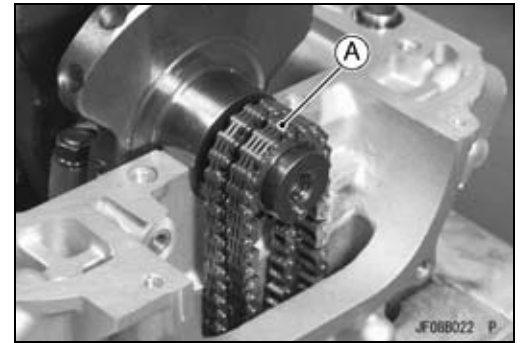
Inlet 36.34 mm (1.431 in.)



Camshaft, Camshaft Chain

Camshaft Chain Removal

- Split the crankcase (see Engine Bottom End chapter).
- Remove the camshaft chain [A] from the crankshaft sprocket.



6-20 ENGINE TOP END

Cylinder Head

Cylinder Compression Measurement

NOTE

○Use the battery which is fully charged.

- Thoroughly warm up the engine, while checking that there is no compression leakage from around the spark plugs or the cylinder head gasket.

CAUTION

Do not run the engine without cooling water supply for more than 15 seconds, especially in high revolutionary speed or severe engine and exhaust system damaged will occur.

- Stop the engine.
- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect both two connection on the ignition coil primary lead connectors [A].
- Remove:
 - Spark Plugs (see Periodic Maintenance chapter)
- Attach the compression gauge [A] and adapter [B] firmly into the spark plug hole.
- Using the starter motor, turn the engine with the throttle fully open until the compression gauge stops rising; the compression is the highest reading obtainable.

Special Tools - Compression Gauge, 20 kgf/cm²: 57001-221
Compression Gauge Adapter, M10 × 1.0: 57001-1317

Cylinder Compression

Usable Range: 1 185 ~ 1 795 kPa (12.1 ~ 18.3 kgf/cm², 172 ~ 260 psi) @430 r/min (rpm)

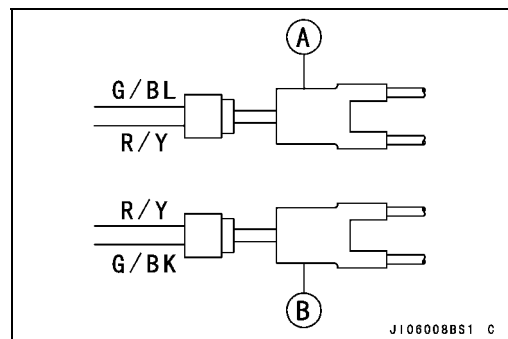
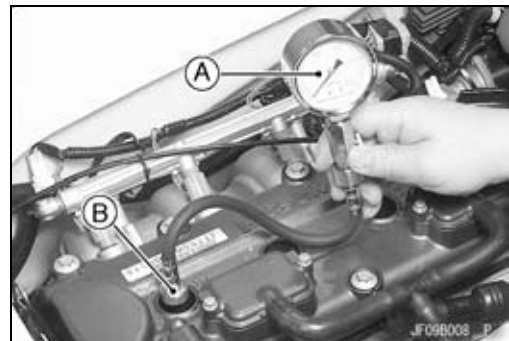
- Repeat the measurement for the other cylinders.
- Install the spark plugs (see Periodic Maintenance chapter).

Torque - Spark Plugs: 13 N·m (1.3 kgf·m, 113 in·lb)

- Reconnect the primary ignition coil lead connectors, noting the #1,#4 [A] and the #2, #3 [B] coil connectors. the #1, #4 coil connector has a red/yellow and a green/blue leads from the main harness. The #2, #3 coil connector has a red/yellow and green/black leads from the main harness.

NOTE

○The service codes (COIL1 and COIL2) caused by this procedure are stored in the ECU. If necessary, these service codes can be erased by using the Kawasaki Diagnostic System (KDS).



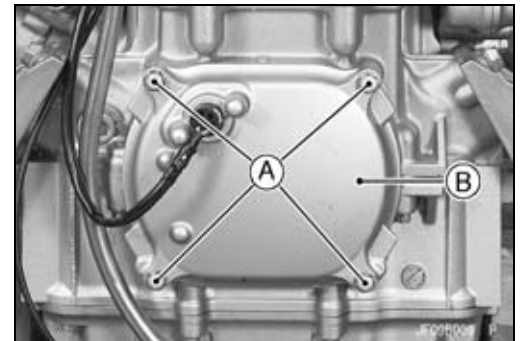
Cylinder Head

The following table should be consulted if the obtainable compression reading is not within the usable range.

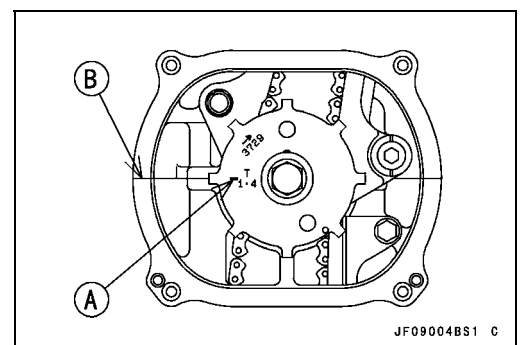
Problem	Diagnosis	Remedy (Action)
Cylinder compression is higher than usable range	Carbon accumulation on piston and in combustion chamber possibly due to damaged valve stem oil seal and/or damaged piston oil rings (This may be indicated by white exhaust smoke).	Remove the carbon deposits and replace damaged parts if necessary.
	incorrect cylinder head gasket thickness.	Replace the gasket with a standard part.
Cylinder compression is lower than usable range	Gas leakage around cylinder head	Replace damaged gasket and check cylinder head warp.
	Bad condition of valve seating	Repair if necessary.
	incorrect valve clearance	Adjust the valve clearance.
	incorrect piston/cylinder clearance	Replace the piston and/or cylinder
	Piston seizure	Inspect the cylinder and replace/repair the cylinder and/or piston as necessary.
	Bad condition of piston ring and/or piston ring grooves	Replace the piston and/or the piston rings.

Cylinder Head Removal

- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Cylinder Head Cover (see Cylinder Head Cover Removal)
- Unscrew the crankshaft sensor cover bolts [A] and remove the crankshaft sensor cover [B].
- Drain the engine oil by one liter.



- Turn the crankshaft clockwise and set the crankshaft at #1, 4 piston TDC.
 - TDC Mark [A] for #1, 4 pistons
 - Timing Mark [B] (Crankcase halves mating surface)
- Remove:
 - Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
 - Camshafts (see Camshaft Removal)

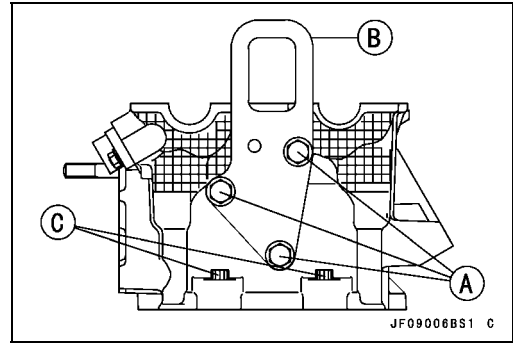


JF09004BS1 C

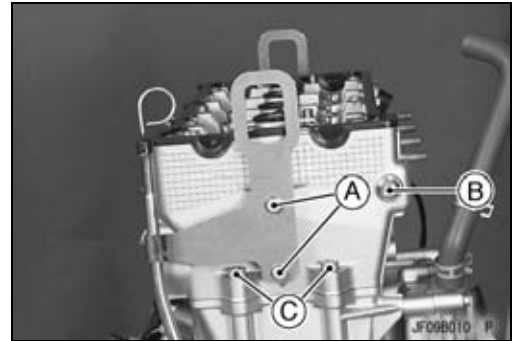
6-22 ENGINE TOP END

Cylinder Head

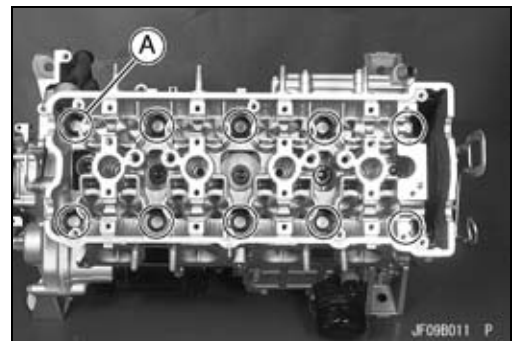
- Remove:
 - Engine Hook Bolts [A]
 - Engine Hook [B]
 - Cylinder Head Bolts [C]



- Remove:
 - Upper Dipstick Tube Bolts [A]
 - Upper Exhaust Side Camshaft Chain Guide Bolt [B]
 - M7 Cylinder Head Bolts [C]



- Remove the M11 cylinder head bolts [A] and washers.
- Take off the cylinder head.

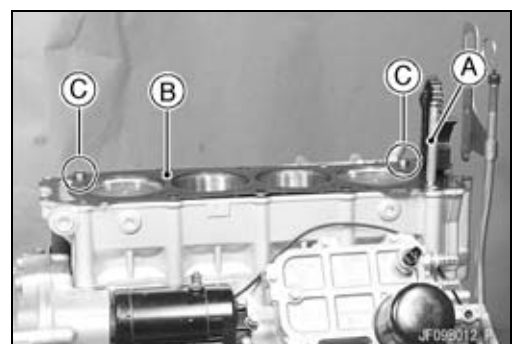
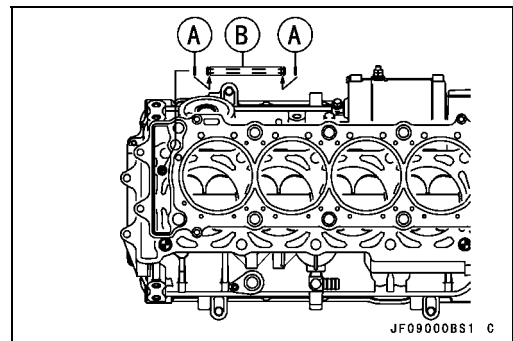


Cylinder Head Installation

NOTE

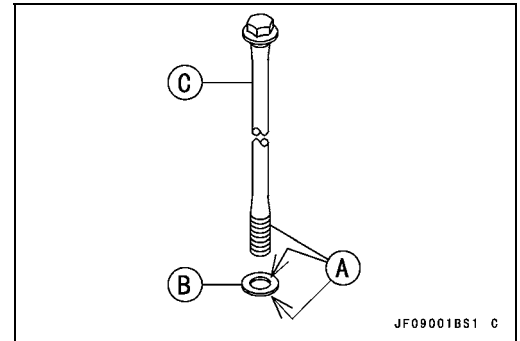
○ The camshaft cap is machined with the cylinder head, so if a new cylinder head is installed, use the cap that is supplied with the new head.

- Replace that the O-rings [A] of the oil pipe [B] and apply molybdenum disulfide oil solution to them.
- Verify that the oil pipe [A] is installed properly.
- Install a new cylinder head gasket [B], and knock pins [C].



Cylinder Head

- Apply molybdenum disulfide oil solution [A] to both sides of the M11 cylinder head bolt washers [B] and the thread of head bolts [C].



- Install the cylinder head.
- First, tighten the M11 cylinder head bolts following the tightening sequence [1 ~ 10].

Torque - Cylinder Head Bolts (M11):

First: 23 N·m (2.3 kgf·m, 17 ft·lb)

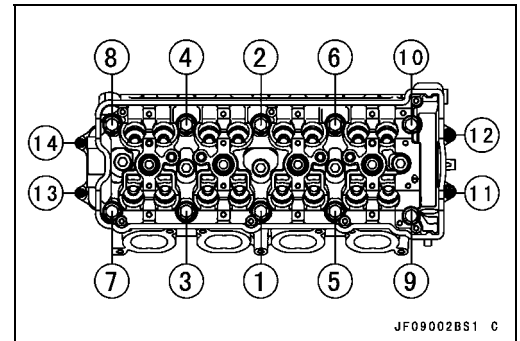
Final: 59 N·m (6.0 kgf·m, 44 ft·lb)

- Next, tighten the M7 cylinder head bolts following the tightening sequence [11 ~ 12].

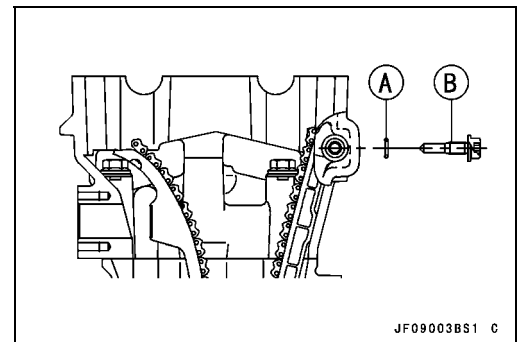
Torque - Cylinder Head Bolts (M7): 20 N·m (2.0 kgf·m, 14 ft·lb)

- Lastly, tighten the M6 cylinder head bolts following the tightening sequence [13 ~ 14].

Torque - Cylinder Head Bolts (M6): 12 N·m (1.2 kgf·m, 104 in·lb)



- Apply grease to the O-ring [A].
- Install:
 - O-ring
 - Upper Exhaust Side Camshaft Chain Guide Bolt [B]
- Tighten:
 - **Torque - Exhaust Side Camshaft Chain Guide Bolt (Upper): 25 N·m (2.5 kgf·m, 18 ft·lb)**
- Install the camshafts (see Camshaft Installation).



Cylinder Head Warp

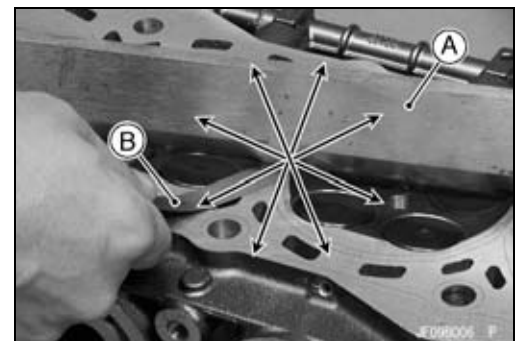
- Remove the cylinder head (see Cylinder Head Removal).
- Clean the cylinder head.
- Lay a straightedge across the lower surface of the cylinder head at several positions.
- Measure the space between the straightedge [A] and the head with a thickness gauge [B].

Cylinder Head Warp

Standard: - - -

Service Limit: 0.05 mm (0.002 in.)

- ★ If the cylinder head is warped more than the service limit, replace it.
- ★ If the cylinder head is warped less than the service limit, repair the head by rubbing the lower surface on emery paper secured to a surface plate (first No. 200, then No. 400).



6-24 ENGINE TOP END

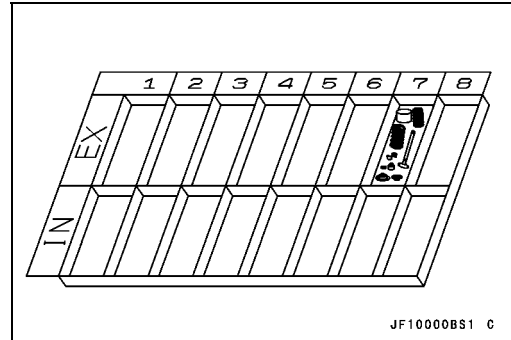
Valves

Valve Clearance Check

- Refer to Valve Clearance Inspection and Adjustment in the Periodic Maintenance chapter.

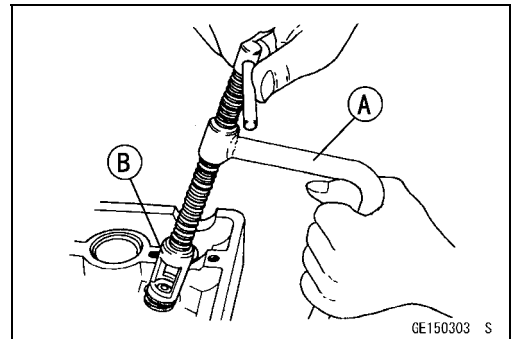
Valve Removal

- Remove the cylinder head (see Cylinder Head Removal).
- Remove the valve lifter and shim.
- Mark and record the valve lifter and shim locations so they can be installed in their original positions.



- Using the valve spring compressor assembly, remove the valve.

Special Tools - Valve Spring Compressor Assembly: 57001-241 [A]
Valve Spring Compressor Adapter, ϕ 22: 57001-1202 [B]

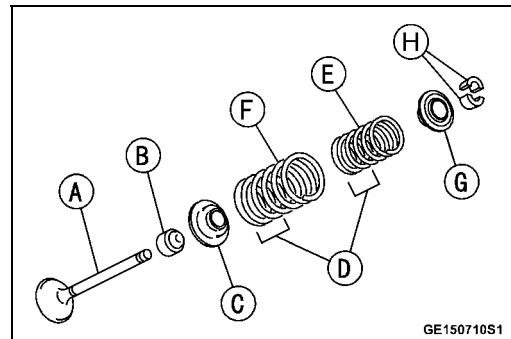


Valve Installation

- Replace the oil seal with a new one.
- Apply thin coat of molybdenum disulfide grease to the valve stem before valve installation.
- Install the springs so that the closed coil end faces downwards.

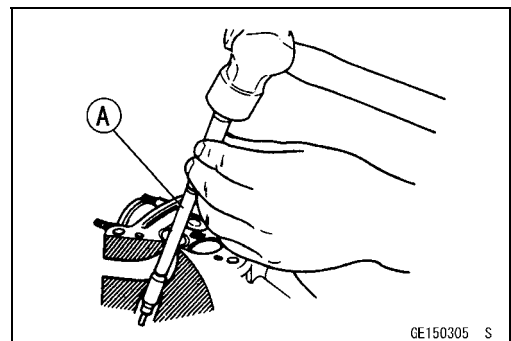
Valve Spring Paint Color: EX-Red
IN-Blue

- [A] Valve Stem
- [B] Oil Seal
- [C] Spring Seat
- [D] Closed Coil End
- [E] Valve Springs (Inner)
- [F] Valve Springs (Outer)
- [G] Retainer
- [H] Split Keepers



Valve Guide Removal

- Remove:
 - Valve (see Valve Removal)
 - Oil Seal
 - Spring Seat
- Heat the area around the valve guide to 120 ~ 150°C (248 ~ 302°F), and hammer lightly on the valve guide arbor [A] to remove the guide from the top of the head.



CAUTION

Do not heat the cylinder head with a torch. This will warp the cylinder head. Soak the cylinder head in oil and heat the oil.

Special Tool - Valve Guide Arbor, ϕ 5: 57001-1203

Valves

Valve Guide Installation

- Apply engine oil to the valve guide outer surface before installation.
- Heat the area around the valve guide hole to about 120 ~ 150°C (248 ~ 302°F).
- Drive the valve guide in from the top of the head using the valve guide arbor. The flange stops the guide from going in too far.

Special Tool - Valve Guide Arbor, ϕ 5: 57001-1203

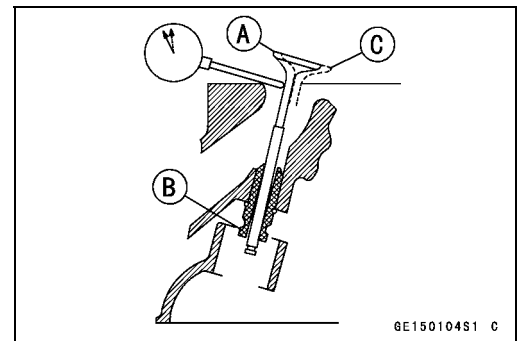
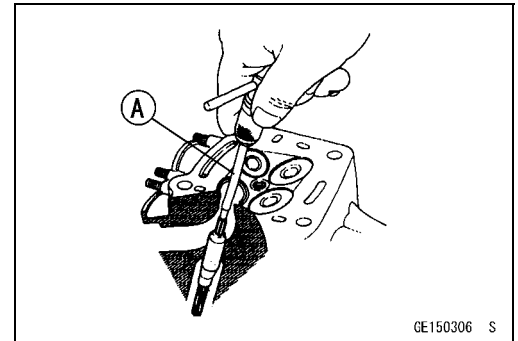
- Ream the valve guide with valve guide reamer [A] even if the old guide is reused.

Special Tool - Valve Guide Reamer, ϕ 5: 57001-1204

Valve-to-Guide Clearance Measurement (Wobble Method)

If a small bore gauge is not available, inspect the valve guide wear by measuring the valve to valve guide clearance with the wobble method as indicated below.

- Insert a new valve [A] into the guide [B] and set a dial gauge against the stem perpendicular to it as close as possible to the cylinder head mating surface.
 - Move the stem back and forth [C] to measure valve/valve guide clearance.
 - Repeat the measurement in a direction at a right angle to the first.
- ★ If the reading exceeds the service limit, replace the guide.



NOTE

○ The reading is not actual valve/valve guide clearance because the measuring point is above the guide.

Valve/Valve Guide Clearance (Wobble Method)

Standard:

Exhaust	0.09 ~ 0.17 mm (0.0035 ~ 0.0067 in.)
Inlet	0.03 ~ 0.11 mm (0.0012 ~ 0.0043 in.)

Service Limit:

Exhaust	0.35 mm (0.014 in.)
Inlet	0.29 mm (0.011 in.)

6-26 ENGINE TOP END

Valves

Valve Seat Inspection

- Remove the valve (see Valve Removal).
- Check the valve seating surface [A] between the valve [B] and valve seat [C].
- Measure the outside diameter [D] of the seating pattern on the valve seat.
- ★ If the outside diameter is too large or too small, repair the seat (see Valve Seat Repair).

Valve Seating Surface Outside Diameter

Standard:

Exhaust 27.6 ~ 27.8 mm (1.087 ~ 1.094 in.)

Inlet 32.6 ~ 32.8 mm (1.283 ~ 1.291 in.)

- Measure the seat width [E] of the portion where there is no build-up carbon (white portion) of the valve seat with a vernier caliper.

Good [F]

- ★ If the width is too wide [G], too narrow [H] or uneven [J], repair the seat (see Valve Seat Repair).

Valve Seating Surface Width

Standard:

Exhaust 0.8 ~ 1.2 mm (0.03 ~ 0.047 in.)

Inlet 0.5 ~ 1.0 mm (0.02 ~ 0.039 in.)

Valve Seat Repair

- Repair the valve seat with the valve seat cutters [A].

Special Tools- Valve Seat Cutter Holder, $\phi 5$:
57001-1208 [B]

Valve Seat Cutter Holder Bar:
57001-1128 [C]

[For Inlet Valve Seat]

Valve Seat Cutter, 45° - $\phi 35$:
57001-1116

Valve Seat Cutter, 32° - $\phi 35$:
57001-1121

Valve Seat Cutter, 55° - $\phi 35$:
57001-1247

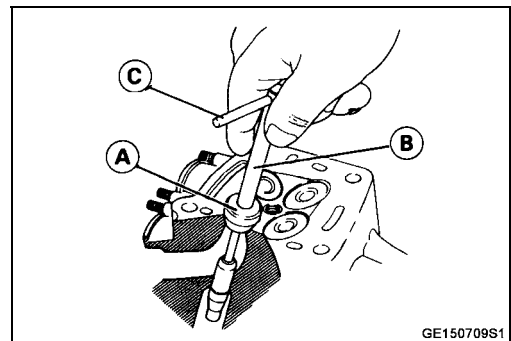
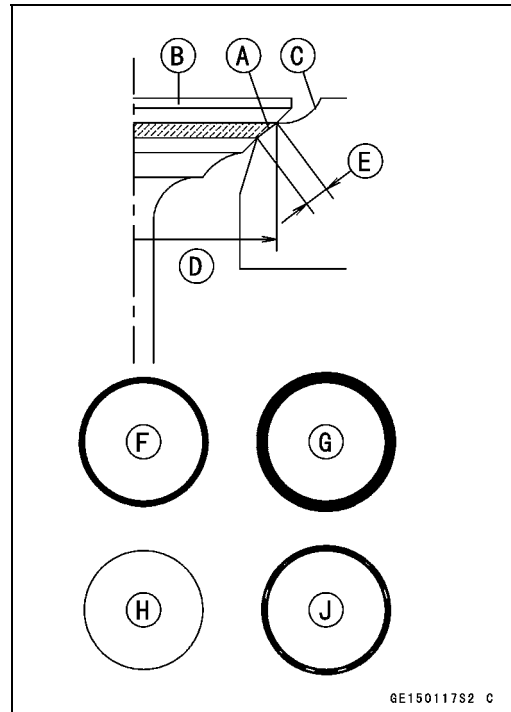
[For Exhaust Valve Seat]

Valve Seat Cutter, 45° - $\phi 30$:
57001-1187

Valve Seat Cutter, 32° - $\phi 30$:
57001-1120

Valve Seat Cutter, 60° - $\phi 30$:
57001-1123

- ★ If the manufacturer's instructions are not available, use the following procedure.



Valves

Seat Cutter Operation Care

1. This valve seat cutter is developed to grind the valve for repair. Therefore the cutter must not be used for other purposes than seat repair.
2. Do not drop or shock the valve seat cutter, or the diamond particles may fall off.
3. Do not fail to apply engine oil to the valve seat cutter before grinding the seat surface. Also wash off ground particles sticking to the cutter with washing oil.

NOTE

○Do not use a wire brush to remove the metal particles from the cutter. It will take off the diamond particles.

4. Setting the valve seat cutter holder in position, operate the cutter in one hand. Do not apply too much force to the diamond portion.

NOTE

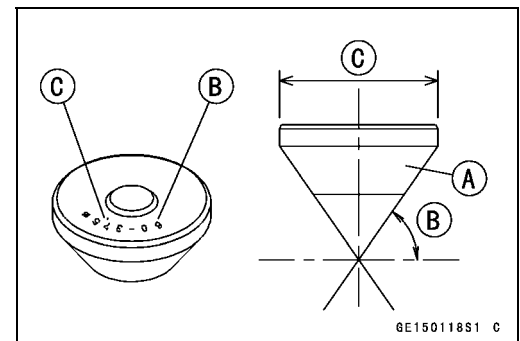
○Prior to grinding, apply engine oil to the cutter and during the operation, wash off any ground particles sticking to the cutter with washing oil.

5. After use, wash it with washing oil and apply thin layer of engine oil before storing.

Marks Stamped on the Cutter

The marks stamped on the back of the cutter [A] represent the following.

- 60° Cutter angle [B]
 37.5φ Outer diameter of cutter [C]



Operating Procedures

- Clean the seat area carefully.
- Coat the seat with machinist's dye.
- Fit a 45° cutter into the holder and slide it into the valve guide.
- Press down lightly on the handle and turn it right or left. Grind the seating surface only until it is smooth.

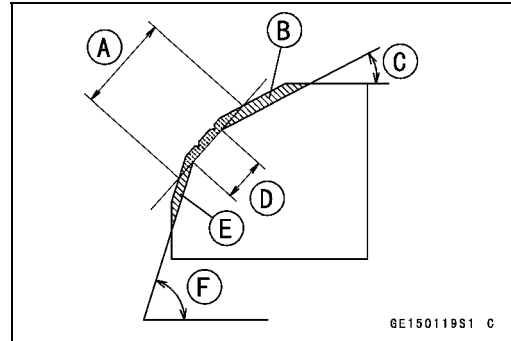
CAUTION

Do not grind the seat too much. Overgrinding will reduce valve clearance by sinking the valve into the head. If the valve sinks too far into the head, it will be impossible to adjust the clearance, and the cylinder head must be replaced.

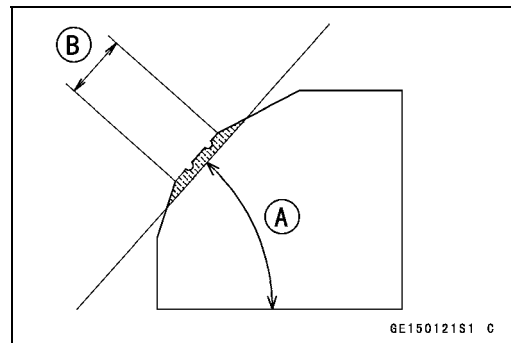
6-28 ENGINE TOP END

Valves

- Measure the outside diameter of the seating surface with a vernier caliper.
- ★ If the outside diameter of the seating surface is too small, repeat the 45° grind until the diameter is within the specified range.
 - Widened Width [A] of engagement by machining with 45° cutter
 - Ground Volume [B] by 32° cutter
 - 32° [C]
 - Correct Width [D]
 - Ground Volume [E] by 60° or 55° cutter
 - 60° or 55° [F]

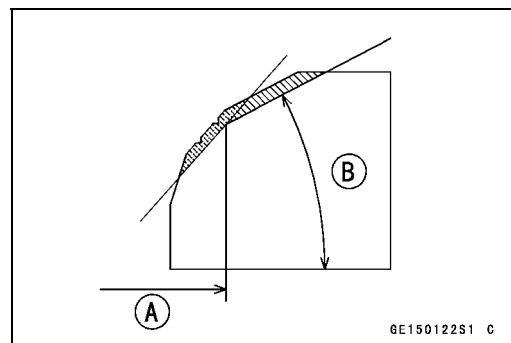


- Measure the outside diameter of the seating surface with a vernier caliper.
- ★ If the outside diameter of the seating surface is too small, repeat the 45° grind [A] until the diameter is within the specified range.
 - Original Seating Surface [B]



NOTE

- Remove all pittings of flaws from 45° ground surface.
- After grinding with 45° cutter, apply thin coat of machinist's dye to seating surface. This makes seating surface distinct and 32° and 60° grinding operation easier.
- When the valve guide is replaced, be sure to grind with 45° cutter for centering and good contact.
- ★ If the outside diameter [A] of the seating surface is too large, make the 32° grind described below.
- ★ If the outside diameter of the seating surface is within the specified range, measure the seat width as described below.
- Grind the seat at a 32° angle [B] until the seat O.D. is within the specified range.
 - To make the 32° grind, fit a 32° cutter into the holder, and slide it into the valve guide.
 - Turn the holder one turn at a time while pressing down very lightly. Check the seat after each turn.



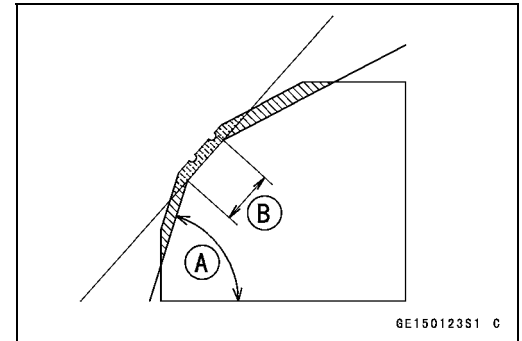
CAUTION

The 32° cutter removes material very quickly. Check the seat outside diameter frequently to prevent overgrinding.

- After making the 32° grind, return to the seat O.D. measurement step above.
- To measure the seat width, use a vernier caliper to measure the width of the 45° angle portion of the seat at several places around the seat.
- ★ If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then return to the seat O.D. measurement step above.

Valves

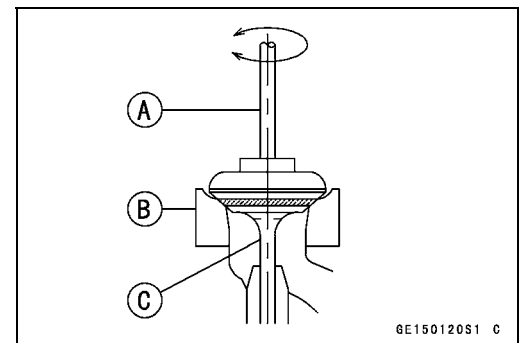
- ★ If the seat width is too wide, make the 60° or 55° [A] grind described below.
 - ★ If the seat width is within the specified range, lap the valve to the seat as described below.
 - Grind the seat at a 60° or 55° angle until the seat width is within the specified range.
 - To make the 60° or 55° grind, fit 60° or 55° cutter into the holder, and slide it into the valve guide.
 - Turn the holder, while pressing down lightly.
 - After making the 60° or 55° grind, return to the seat width measurement step above.
- Correct Width [B]



- Lap the valve to the seat, once the seat width and O.D. are within the ranges specified above.
- Put a little coarse grinding compound on the face of the valve in a number of places around the valve head.
- Spin the valve against the seat until the grinding compound produces a smooth, matched surface on both the seat and the valve.
- Repeat the process with a fine grinding compound.

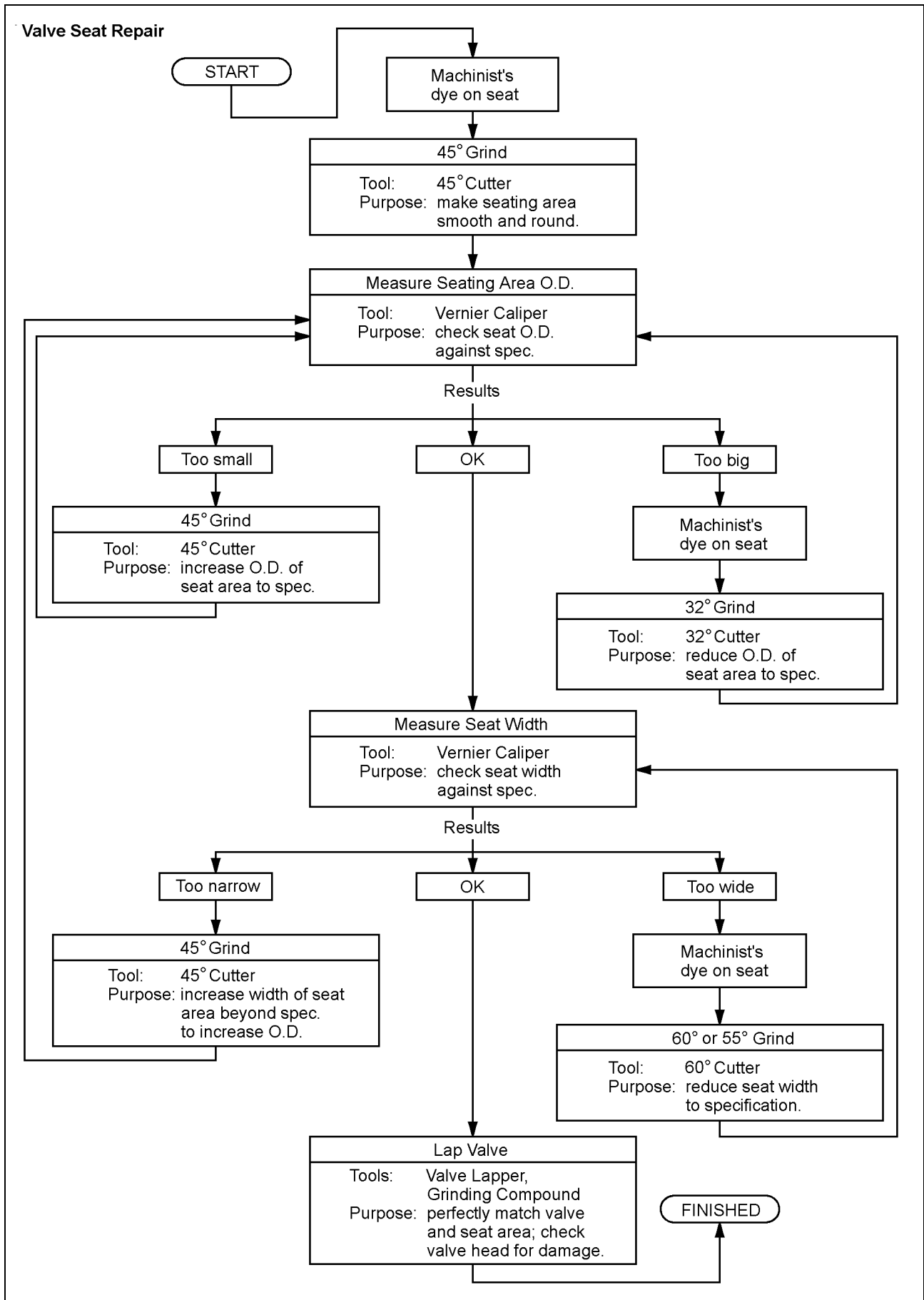
[A] Lapper
[B] Valve Seat
[C] Valve

- The seating area should be marked about in the middle of the valve face.
- ★ If the seat area is not in the right place on the valve, check to be sure the valve is the correct part. If it is, it may have been refaced too much; replace it.
- Be sure to remove all grinding compound before assembly.
- When the engine is assembled, be sure to adjust the valve clearance (see Valve Clearance Adjustment section of Periodic Maintenance chapter).



6-30 ENGINE TOP END

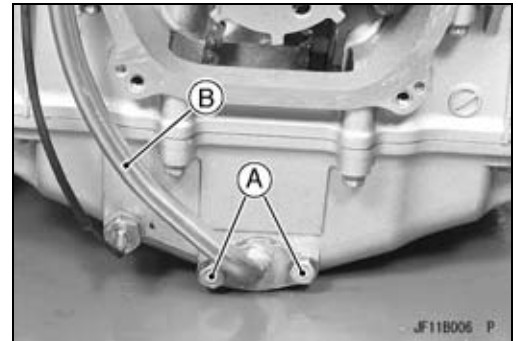
Valves



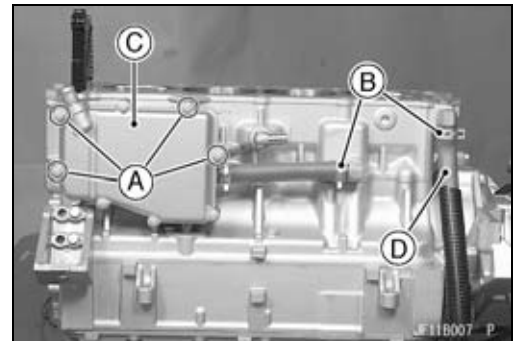
Cylinder, Pistons

Cylinder Removal

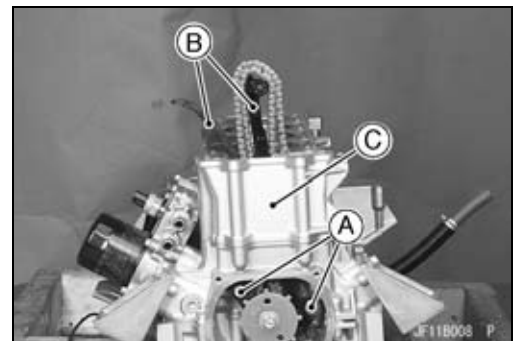
- Drain the engine oil (see Periodic Maintenance chapter).
- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Cylinder Head (see Cylinder Head Removal)
 - Dipstick Tube Bolts [A]
 - Dipstick Tube [B]



- Remove:
 - Breather Case Mounting Bolts [A]
 - Clamp [B]
 - Breather Case [C] (with Hose)
 - Oil Hose [D]



- Remove:
 - Camshaft Chain Guide Bolts [A]
 - Camshaft Chain Guide [B]
 - Cylinder [C]



Piston Removal

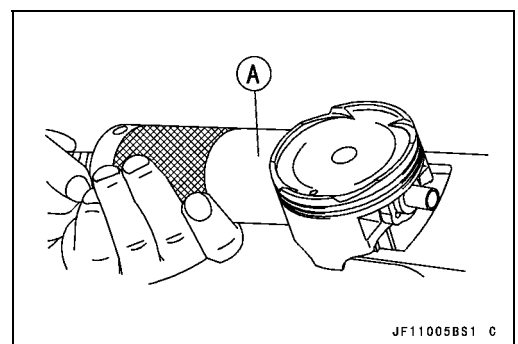
- Remove the cylinder (see Cylinder Removal).
- Place a clean cloth under the pistons and remove the piston pin snap ring [A] from the outside of each piston.

CAUTION

Do not reuse the snap rings, as removal weakens and deforms them. They fall out and score the cylinder wall.



- Remove the piston pins with a piston pin puller [A].
 - Special Tool - Piston Pin Puller Assembly: 57001-910**
- Remove the pistons.

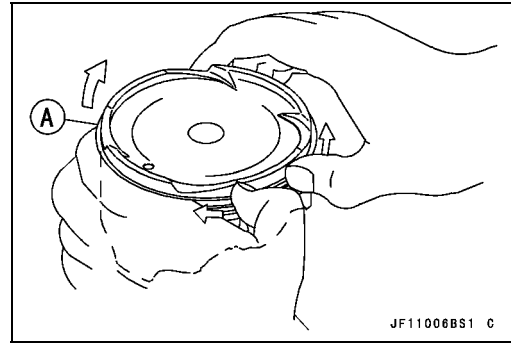


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6-32 ENGINE TOP END

Cylinder, Pistons

- Carefully spread the ring opening with your thumbs and then push up on the opposite side of the ring [A] to remove it.
- Remove the 3-piece oil ring with your thumbs in the same manner.

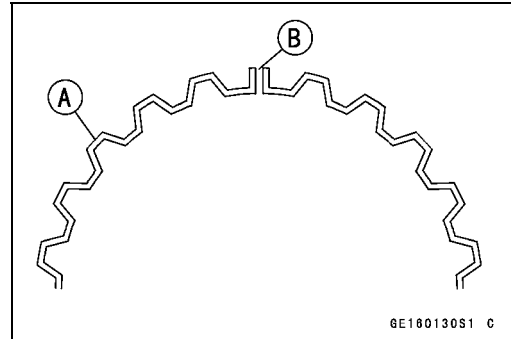


Piston/Cylinder Installation

NOTE

- If a new cylinder is used, use new piston rings.
- If new pistons and/or a new cylinder are installed, apply thin coat of molybdenum disulfide oil solution to the new pistons and cylinder bores.

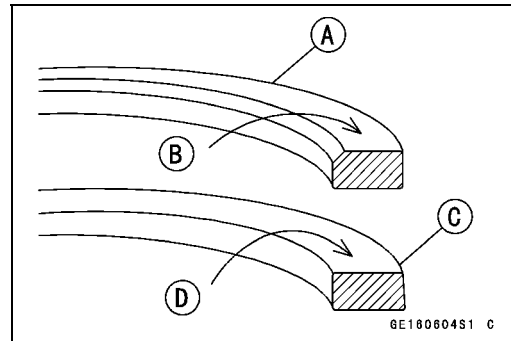
- Install the oil ring expander [A] in the bottom piston ring groove so the ends [B] butt together.
- Install the oil ring steel rails, one above the expander and one below it.
- Spread the rail with your thumbs, but only enough to fit the rail over the piston.
- Release the rail into the bottom piston ring groove.



NOTE

- The oil ring rails have no "top" or "bottom".

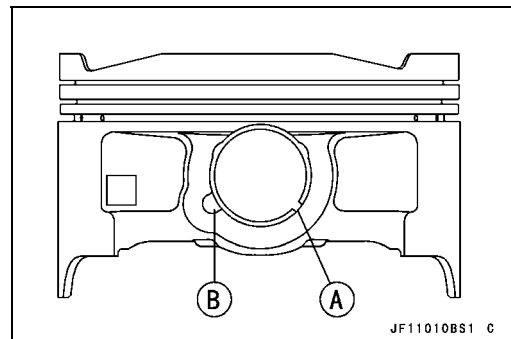
- Do not mix up the top and second ring.
- Install the top ring [A] so that the "R" mark [B] faces up.
- Install the second ring [C] so that the "RN" mark [D] faces up.
- Apply molybdenum disulfide oil solution to the piston rings.



NOTE

- If a new piston is used, use new piston ring.

- Install the piston with its marking hollow facing exhaust side.
- Fit a new piston pin snap ring into the side of the piston so that the ring opening [A] does not coincide with the slit [B] of the piston pin hole.
- Apply molybdenum disulfide oil solution to the piston pins and piston journals.
- When installing the piston pin snap ring, compress it only enough to install it and no more.



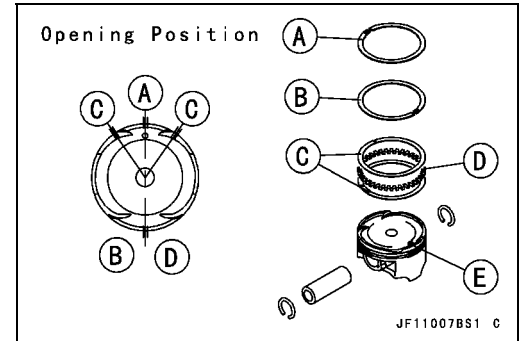
CAUTION

**Do not reuse snap rings, as removal weakens and deforms them.
They could fall out and score the cylinder wall.**

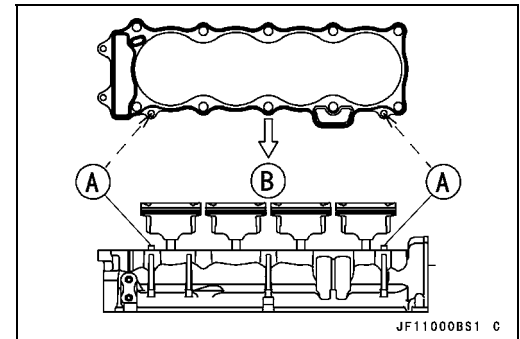
Cylinder, Pistons

- The piston ring openings must be positioned as shown in the figure. The openings of the oil ring steel rails must be about 30 ~ 40° of angle from the opening of the top ring.

- [A] Top Ring
- [B] Second Ring
- [C] Oil Ring Steel Rails
- [D] Oil Ring Expander
- [E] Hollow (Exhaust Side)



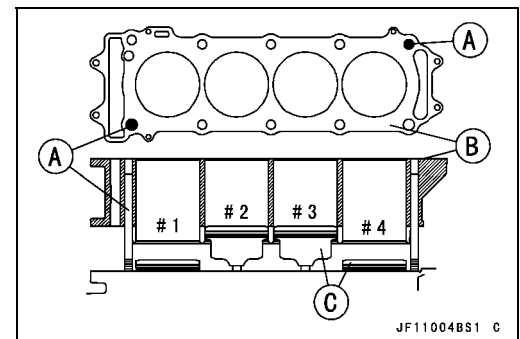
- Replace the cylinder gasket with a new one, and install the pins [A] and new cylinder gasket. Exhaust Side [B]
- Apply molybdenum disulfide oil solution to the cylinder bore, external of pistons and piston rings.



- Insert the piston in the cylinder by two methods.

With the Hand

- Position the crankshaft at #2, #3 piston TDC.
- Install the two cylinder head bolts [A] diagonally in the crankcase.
- Install the cylinder block [B].
- Install the pistons [C].
- First insert the #2, #3 pistons, and then rotate the crankshaft at 90° angle.
- Insert the piston rings with your thumbs or the thin (-) screw driver.



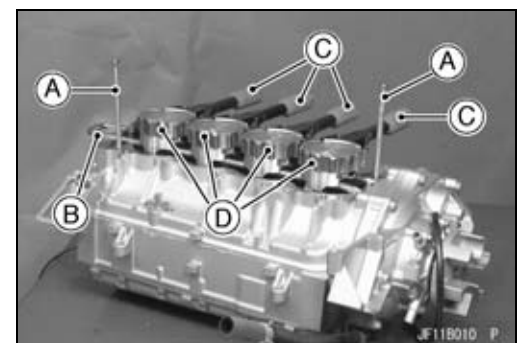
With the Special Tools

- Install the two cylinder head bolts [A] diagonally in the crankcase.
- Slip the piston bases [B] under the pistons to hold them level.
- Compress the piston rings using the piston ring compressor grips [C] and piston ring compressor belts [D] with chamfered side upward.

Special Tools - Piston Base, φ8: 57001-1604

Piston Ring Compressor Grip: 57001-1095

Piston Ring Compressor Belt, φ80 ~ φ91: 57001-1320



- Push down vigorously the cylinder aligning the cylinder bores with all the piston heads.
- Install the cylinder so that its angle aligns the piston angle after removing the piston ring compressor belts.
- Install the removed parts.

6-34 ENGINE TOP END

Cylinder, Pistons

Cylinder Wear

- Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the two locations (total of four measurements) shown in the figure.

★ If any of the cylinder inside diameter measurements exceeds the service limit, replace the cylinder.

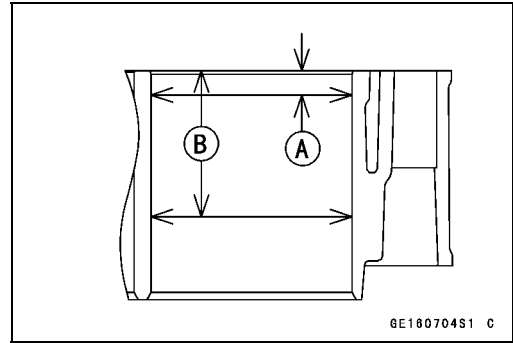
[A] 10 mm (0.39 in.)

[B] 60 mm (2.36 in.)

Cylinder Inside Diameter

Standard: 82.994 ~ 83.006 mm (3.2675 ~ 3.2679 in.)

Service Limit: 83.10 mm (3.272 in.)



Piston Wear

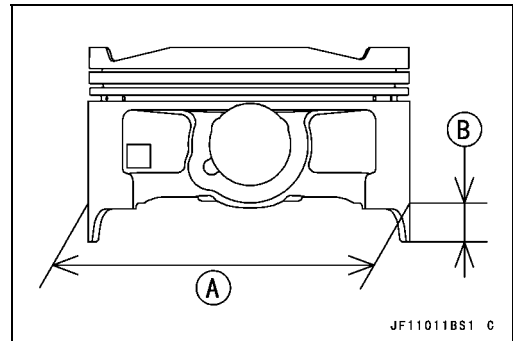
- Measure the outside diameter [A] of each piston 18 mm (0.71 in.) [B] up from the bottom of the piston at a right angle to the direction of the piston pin.

★ If the measurement is less than the service limit, replace the piston.

Piston Diameter

Standard: 82.919 ~ 82.934 mm (3.2645 ~ 3.2651 in.)

Service Limit: 82.77 mm (3.259 in.)



Piston Ring, Piston Ring Groove Wear

- Check for uneven groove wear by inspecting the ring seating.

★ The rings should fit perfectly parallel to groove surfaces. If not, replace the piston and all the piston rings.

- With the piston rings in their grooves, make several measurements with a thickness gauge [A] to determine piston ring/groove clearance.

Piston Ring/Groove Clearance

Standard:

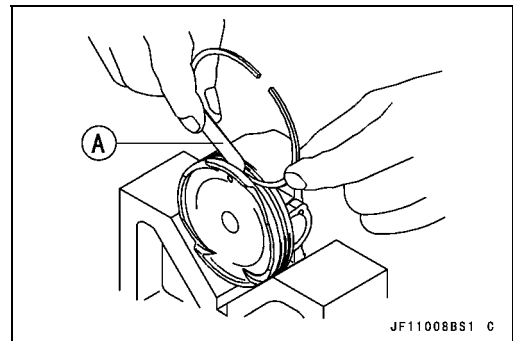
Top 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)

Second 0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in.)

Service Limit:

Top 0.17 mm (0.0067 in.)

Second 0.16 mm (0.0063 in.)



Piston Ring Groove Width

- Measure the piston ring groove width.

○ Use a vernier caliper at several points around the piston.

Standard:

Top [A] 0.92 ~ 0.94 mm (0.0362 ~ 0.0370 in.)

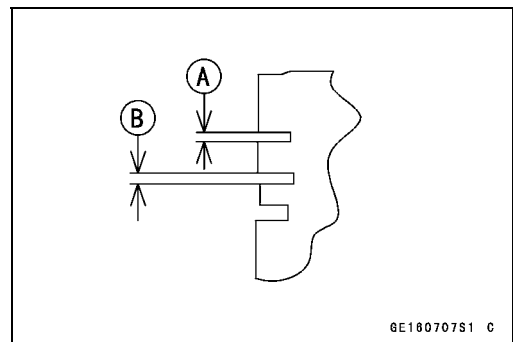
Second [B] 1.01 ~ 1.03 mm (0.0398 ~ 0.0406 in.)

Service Limit:

Top [A] 1.02 mm (0.0402 in.)

Second [B] 1.11 mm (0.0437 in.)

★ If the width of any of the two grooves is wider than the service limit at any point, replace the piston.



Cylinder, Pistons

Piston Ring Thickness

- Measure the piston ring thickness.
- Use the micrometer to measure at several points around the ring.

Piston Ring Thickness

Standard:

Top [A] 0.87 ~ 0.89 mm (0.0343 ~ 0.0350 in.)

Second [B] 0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)

Service Limit:

Top [A] 0.80 mm (0.0315 in.)

Second [B] 0.90 mm (0.0354 in.)

- ★ If any of the measurements is less than the service limit on either of the rings, replace all the rings.

NOTE

- When using new rings in a used piston, check for uneven groove wear. The rings should fit perfectly parallel to the groove sides. If not, replace the piston.

Piston Ring End Gap

- Place the piston ring [A] inside the cylinder, using the piston to locate the ring squarely in place. Set it close to the bottom of the cylinder, where cylinder wear is low.
- Measure the gap between the ends of the ring with a thickness gauge [B].

Piston Ring End Gap

Standard:

Top 0.25 ~ 0.40 mm (0.0098 ~ 0.0157 in.)

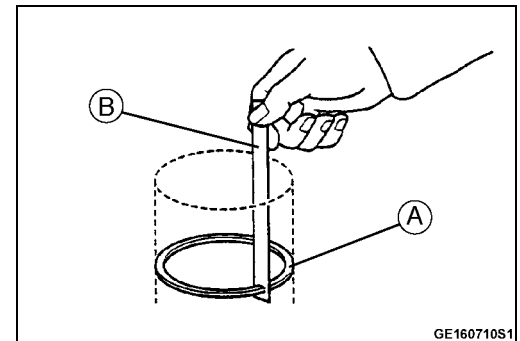
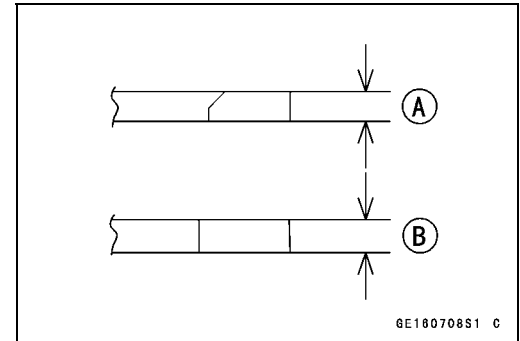
Second 0.40 ~ 0.55 mm (0.0157 ~ 0.0217 in.)

Service Limit:

Top 0.7 mm (0.0276 in.)

Second 0.8 mm (0.0315 in.)

- ★ If the end gap of either ring is greater than the service limit, replace all the rings.



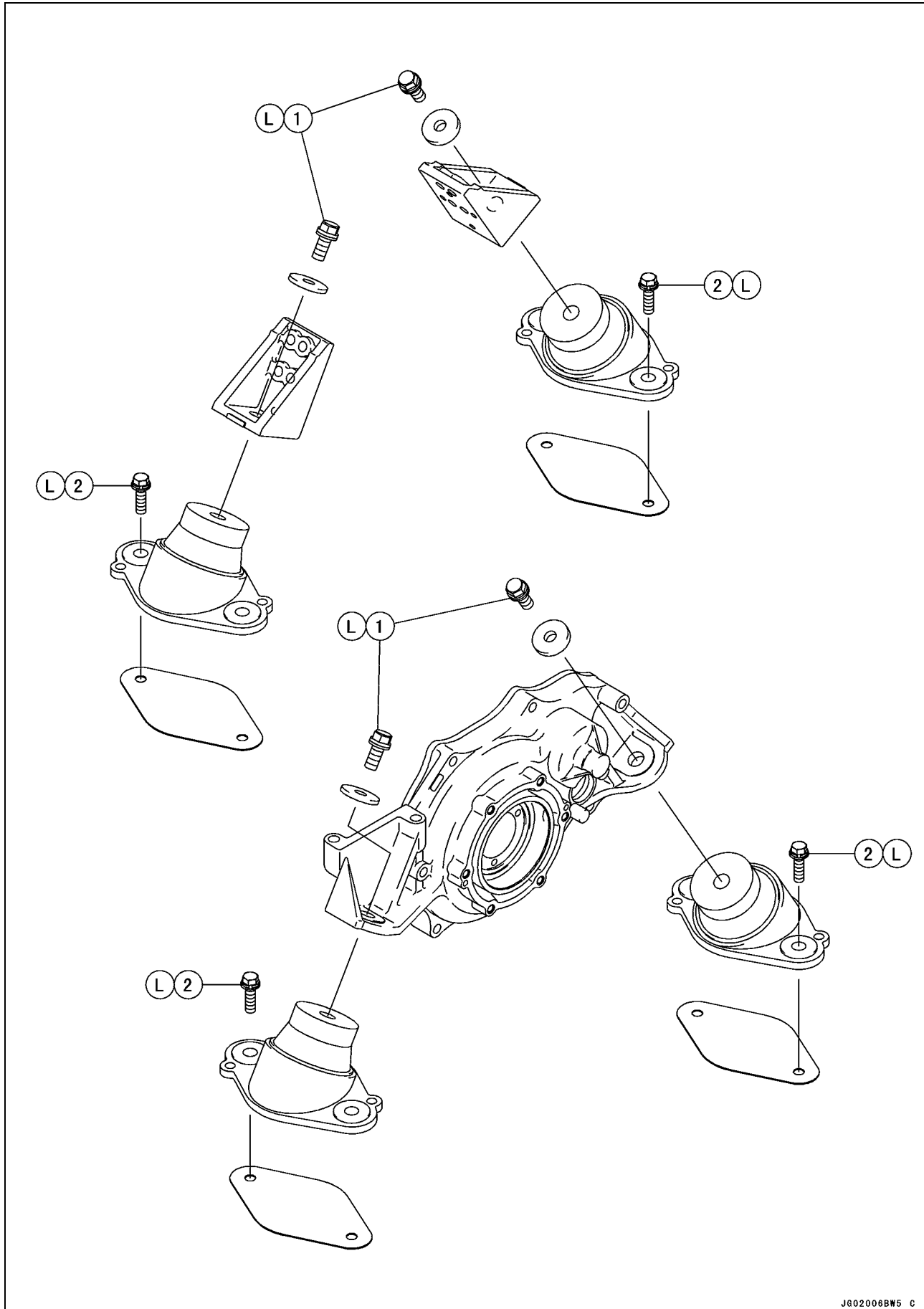
Engine Removal/Installation

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7-2 ENGINE REMOVAL/INSTALLATION

Exploded View



ENGINE REMOVAL/INSTALLATION 7-3

Exploded View

No	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Mounting Bolts	36	3.7	27	L
2	Engine Damper Mounting Bolts	16	1.6	12	L

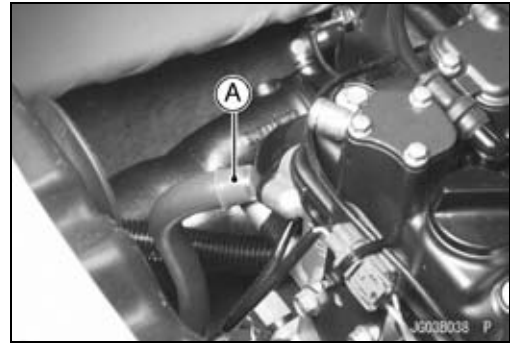
L: Apply a non-permanent locking agent.

7-4 ENGINE REMOVAL/INSTALLATION

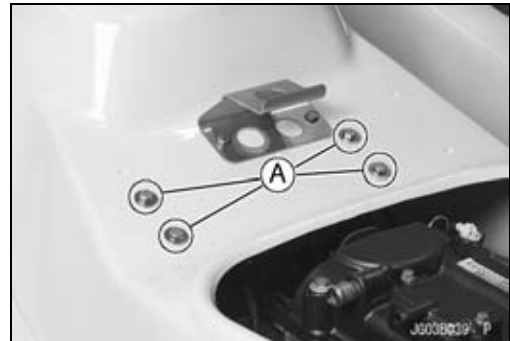
Engine Removal/Installation

Engine Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Oil Separator Tank (see Lubrication Sytem)
- Plug the hose end [A].
- ★ If the engine disassembles, drain the oil (see Engine Oil Change in Periodic Maintenance chapter).



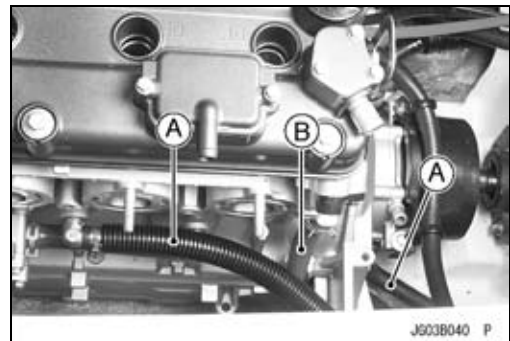
- Remove:
 - Air Filter (see Fuel System (DFI) chapter)
 - Inlet Manifold (see Fuel System (DFI) chapter)
 - Exhaust Manifold (see Exhaust System chapter)
 - Bolts [A] and Ignition Coil Bracket



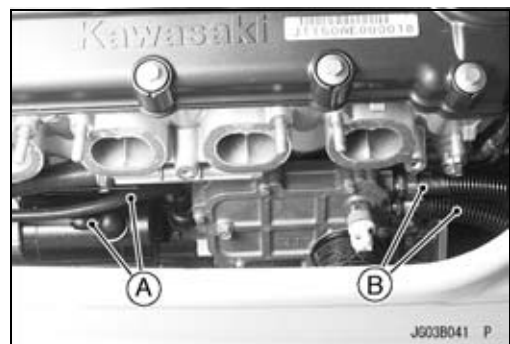
- Remove:
 - Cooling Hoses [A]
- The oil hose [B] is not necessary removal.

NOTE

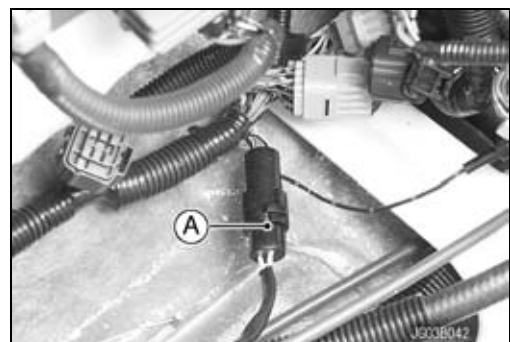
○ If the oil is in the engine and the removed hose lies down, the oil will flow out from hose end.



- Remove:
 - Starter Motor Cables [A]
 - Cooling Hoses [B]

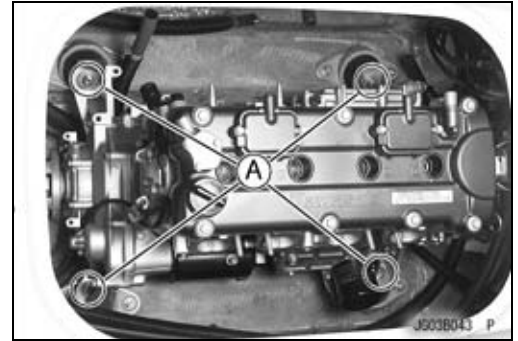


- Disconnect:
 - Alternator Lead Connector [A]



Engine Removal/Installation

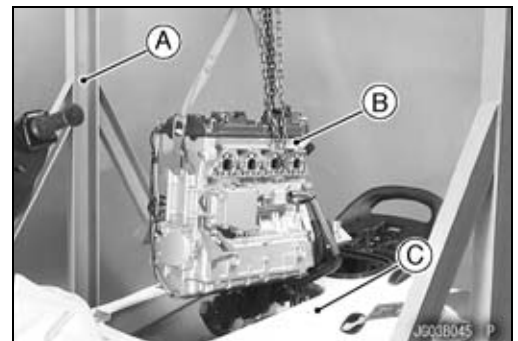
- Remove:
Engine Mounting Bolts [A]



- Slide the engine toward the front to disengage the coupling [A].



- Using the lifter [A], raise the front side of the engine a little and lift the engine [B] out off the hull [C].

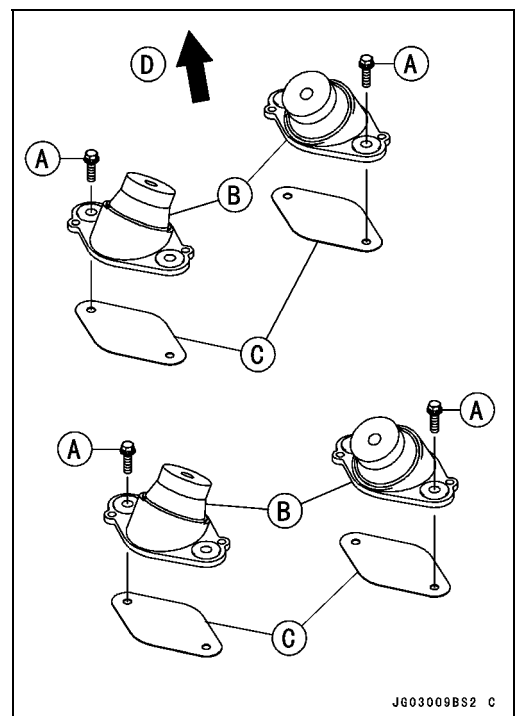


Engine Damper Removal

- Remove:
Engine Damper Mounting Bolts [A]
Engine Damper [B]
Shim [C] (0 ~ 2 pieces)
Bow [D]
- Record the number of shims of four positions so they can be put back in the same position.

CAUTION

Install the shims to the same position. Incorrect shims could cause drive shaft misalignment.



7-6 ENGINE REMOVAL/INSTALLATION

Engine Removal/Installation

Engine Damper Installation

- Install the shim(s) of the same number.
- Apply a non-permanent locking agent to the engine damper mount bolts, and tighten them.

Torque - Engine Damper Mounting Bolts: 16 N·m (1.6 kgf·m, 12 ft·lb)

Engine Installation

- Be sure there are no foreign objects and parts inside of the hull.
- Clean the bilge filter (see Filter Cleaning and Inspection in Cooling and Bilge Systems chapter).
- Check the coupling damper for wear damage (see Coupling Damper Inspection in Engine Bottom End chapter).
- Install the inlet manifold (see Fuel System chapter).
- Apply a non-permanent locking agent to the engine mounting bolts, and tighten them.

Torque - Engine Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)

- After installing the engine in the hull, check the following.
 - Throttle Cable
 - Fuel and Exhaust Leaks

⚠ WARNING

Do not run the engine in a closed area. Exhaust gases contain carbon monoxide, a colorless, odorless, poisonous gas which can be lethal.

CAUTION

Do not run the engine without cooling water supply for more than 15 seconds, especially in high revolutionary speed or severe engine and exhaust system damage will occur.

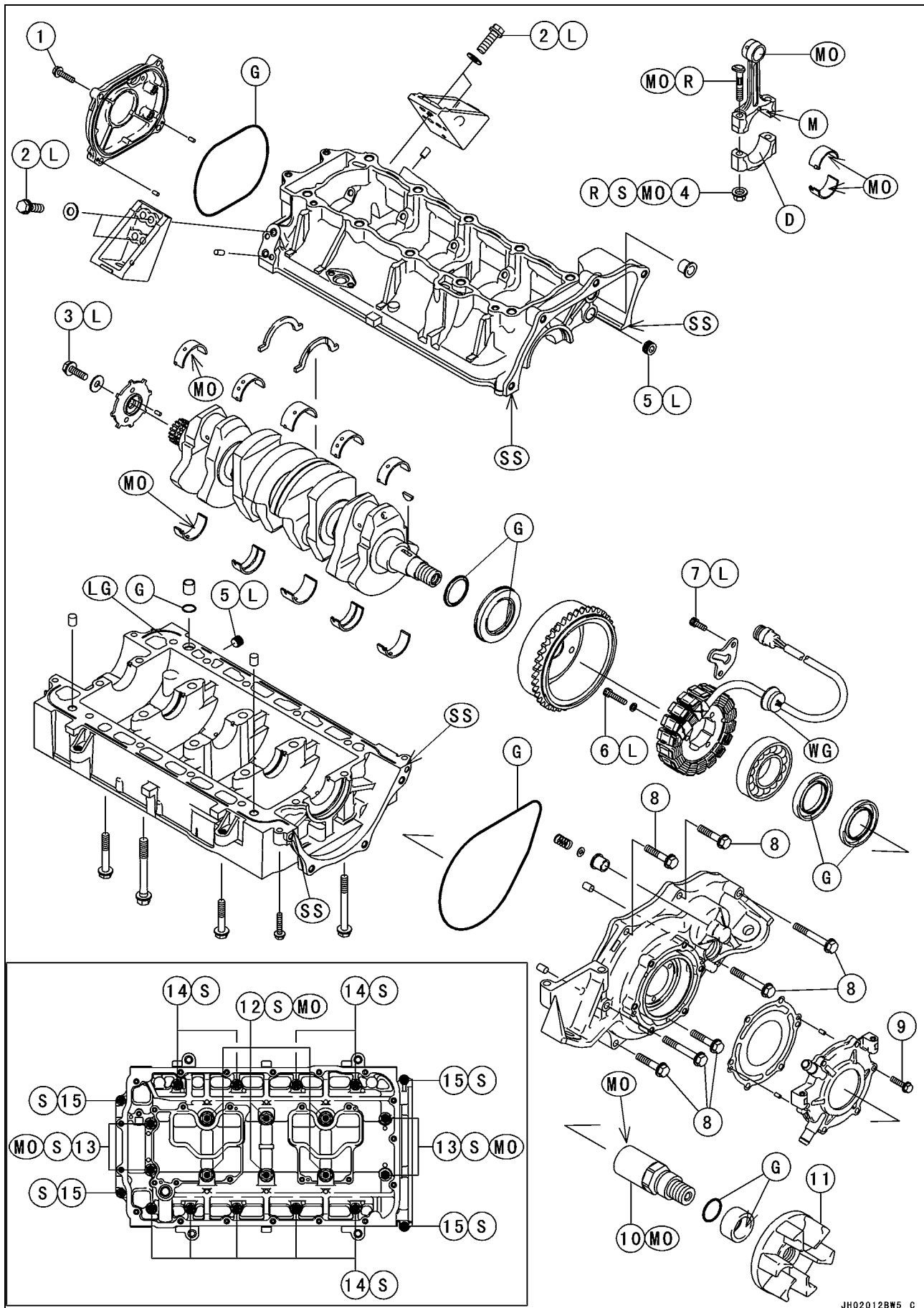
Engine Bottom End

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8-2 ENGINE BOTTOM END

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
2	Engine Bracket Mounting Bolts	29	3.0	22	L
3	Timing Rotor Bolt	29	3.0	22	L
4	Connecting Rod Nuts	–	–	–	MO, see text
5	Oil Passage Plugs	20	2.0	14	L
6	Stator Mounting Bolts	12	1.2	104 in·lb	L
7	Grommet Cover Bolts	9.8	1.0	87 in·lb	L
8	Magneto Cover Bolts	20	2.0	14	
9	Output Cover Bolts	7.8	0.80	69 in·lb	
10	Output Shaft	245	25.0	180	MO
11	Coupling	98	10	72	
12	Crankcase Bolts (M10)	50	5.0	36	MO, S
13	Crankcase Bolts (M8)	29	3.0	22	MO, S
14	Crankcase Bolts (M8)	29	3.0	22	S
15	Crankcase Bolts (M6)	12	1.2	104 in·lb	S

D: Do not apply any grease or oil.

G: Apply grease.

L: Apply a non-permanent locking agent.

LG: Apply liquid gasket (Kawasaki Bond: 92104-1062).

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).

R: Replacement Parts.

S: Follow the specific tightening sequence.

SS: Apply silicone sealant.

WG: Apply water resistant grease.

8-4 ENGINE BOTTOM END

Specifications

Item	Standard	Service Limit
Crankshaft, Connecting Rods		
Connecting Rod Bend	---	0.2/100 mm (0.008/3.94 in.)
Connecting Rod Twist	---	0.2/100 mm (0.008/3.94 in.)
Connecting Rod Big End Side Clearance	0.13 ~ 0.38 mm (0.0051 ~ 0.0150 in.)	0.58 mm (0.023 in.)
Connecting Rod Big end Bearing Insert/crankpin Clearance	0.041 ~ 0.071 mm (0.0016 ~ 0.0028 in.)	0.11 mm (0.0043 in.)
Crankpin Diameter:	38.984 ~ 39.000 mm (1.5348 ~ 1.5354 in.)	38.97 mm (1.534 in.)
Marking:		
None	38.984 ~ 38.992 mm (1.5348 ~ 1.5351 in.)	---
○	38.993 ~ 39.000 mm (1.5352 ~ 1.5354 in.)	---
Connecting Rod Big End Bore Diameter:	42.000 ~ 42.016 mm (1.6535 ~ 1.6542 in.)	---
Marking		
None	42.000 ~ 42.008 mm (1.6535 ~ 1.65386 in.)	---
○	42.009 ~ 42.016 mm (1.65389 ~ 1.6542 in.)	---
Connecting Rod Big End Bearing Insert Thickness:		
Brown	1.475 ~ 1.480 mm (0.05807 ~ 0.05827 in.)	---
Black	1.480 ~ 1.485 mm (0.05827 ~ 0.05846 in.)	---
Blue	1.485 ~ 1.490 mm (0.05846 ~ 0.05866 in.)	---

Connecting Rod Big End Bearing Insert Selection

Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92139-3710
None	None	Black	92139-3709
○	○		
○	None	Blue	92139-3708

Crankshaft Side Clearance	0.05 ~ 0.24 mm (0.0020 ~ 0.0094 in.)	0.44 mm (0.017 in.)
Crankshaft Runout	TIR 0.03 mm (0.0012 in.) or less	TIR 0.07 mm (0.0028 in.)
Crankshaft Main Bearing Insert/journal Clearance	0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in.)	0.08 mm (0.0032 in.)

Specifications

Item	Standard	Service Limit
Crankshaft Main Journal Diameter:	40.984 ~ 41.000 mm (1.6135 ~ 1.6142 in.)	40.96 mm (1.613 in.)
Marking		
None	40.984 ~ 40.992 mm (1.6135 ~ 1.61385 in.)	---
1	40.993 ~ 41.000 mm (1.61389 ~ 1.6142 in.)	---
Crankcase Main Bearing Bore Diameter:	44.000 ~ 44.016 mm (1.7323 ~ 1.7329 in.)	---
Marking		
○	44.000 ~ 44.008 mm (1.7323 ~ 1.73259 in.)	---
None	44.009 ~ 44.016 mm (1.73263 ~ 1.7329 in.)	---
Crankshaft Main Bearing Insert Thickness:		
Brown	1.490 ~ 1.494 mm (0.05866 ~ 0.05882 in.)	---
Black	1.494 ~ 1.498 mm (0.05882 ~ 0.05898 in.)	---
Blue	1.498 ~ 1.502 mm (0.05898 ~ 0.05913 in.)	---

Crankshaft Main Bearing Insert Selection

Crankcase Main Bearing Bore Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert*		
		Size Color	Part Number	Journal Nos.
○	1	Brown	92139-3704	1, 5
			92139-3713	3
			92139-3707	2, 4
○	None	Black	92139-3703	1, 5
None	1		92139-3712	3
		92139-3706	2, 4	
None	None	Blue	92139-3702	1, 5
			92139-3711	3
			92139-3705	2, 4

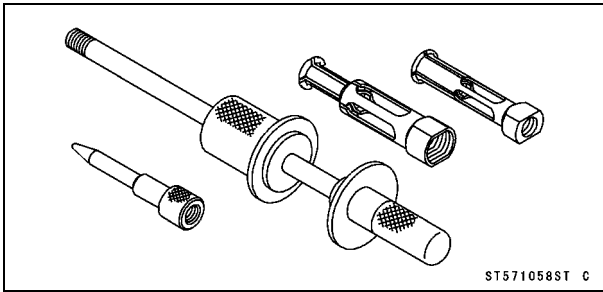
*The bearing inserts for Nos. 2 and 4 journals have an oil groove, respectively.

8-6 ENGINE BOTTOM END

Special Tools and Sealant

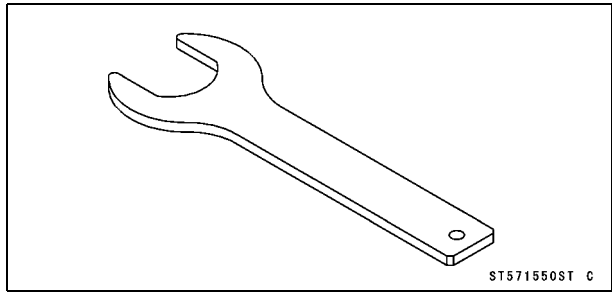
Oil Seal & Bearing Remover:

57001-1058



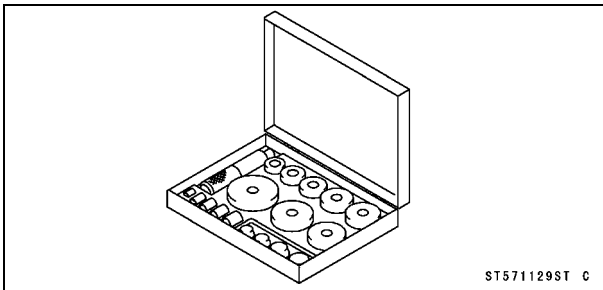
Output Shaft Wrench, Hex 36:

57001-1550



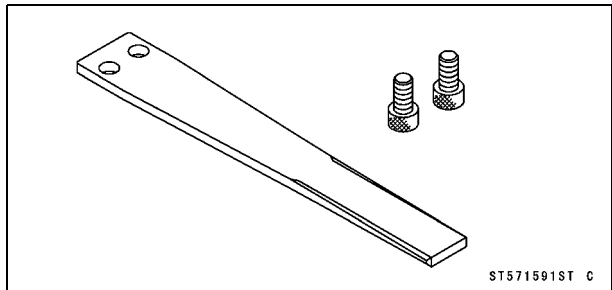
Bearing Driver Set:

57001-1129



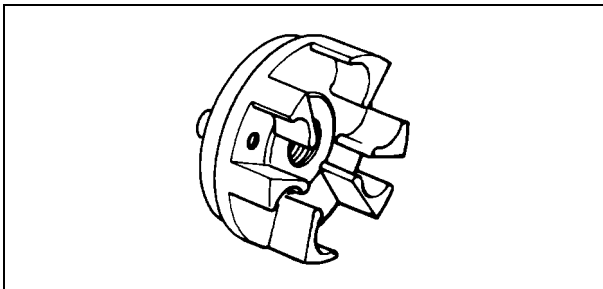
Grip:

57001-1591



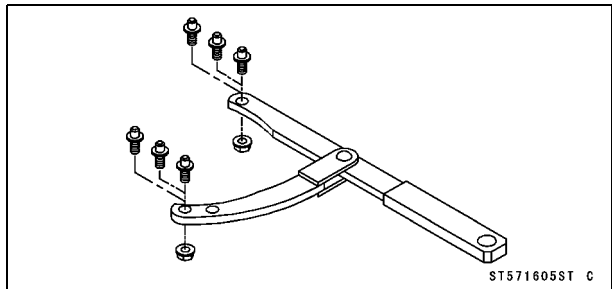
Coupling Holder #2:

57001-1423



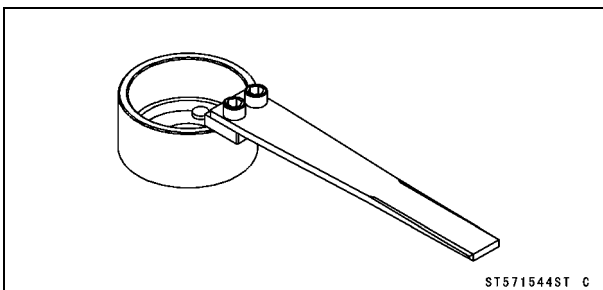
Flywheel & Pulley Holder:

57001-1605



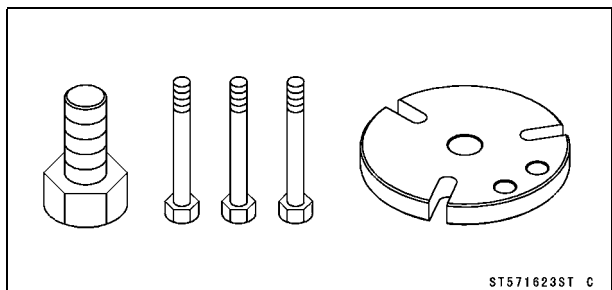
Rotor Holder:

57001-1544



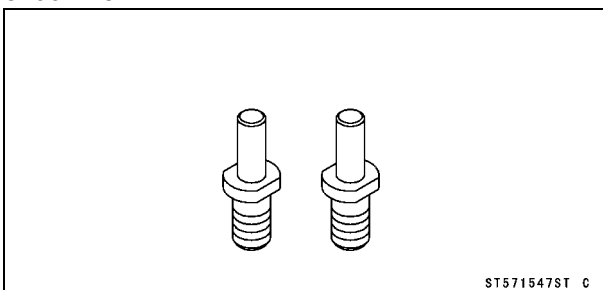
Rotor Puller:

57001-1623



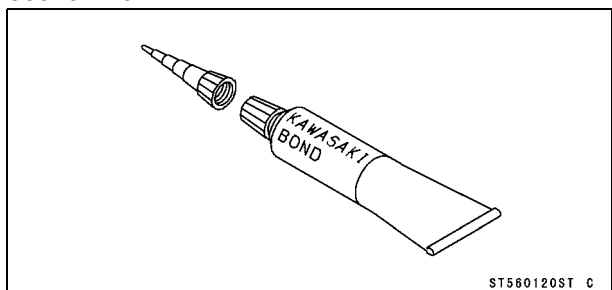
Holder Attachment:

57001-1547



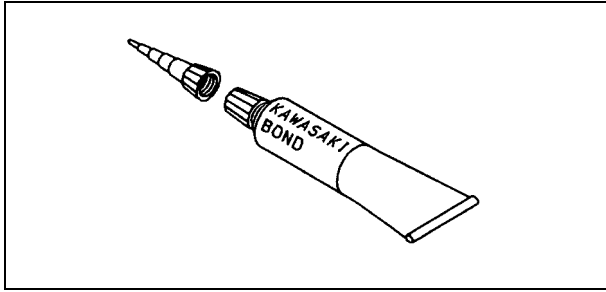
Kawasaki Bond (Silicone Sealant):

56019-120



Special Tools and Sealant

Kawasaki Bond (Liquid Gasket - Black):
92104-1062



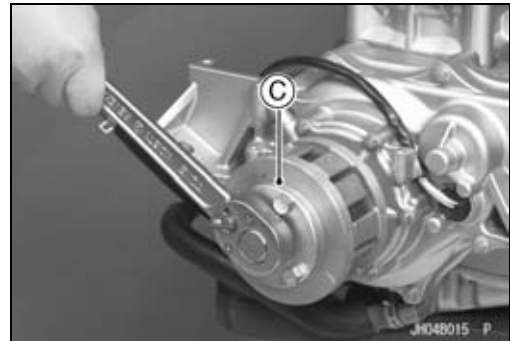
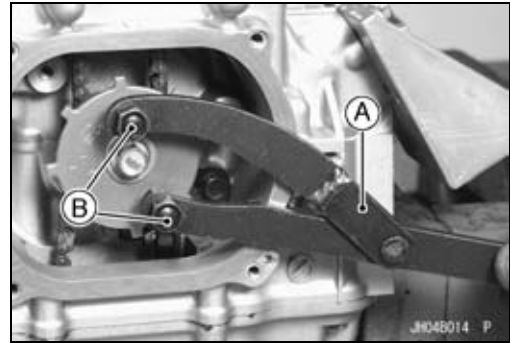
8-8 ENGINE BOTTOM END

Coupling

Coupling/Output Shaft Removal

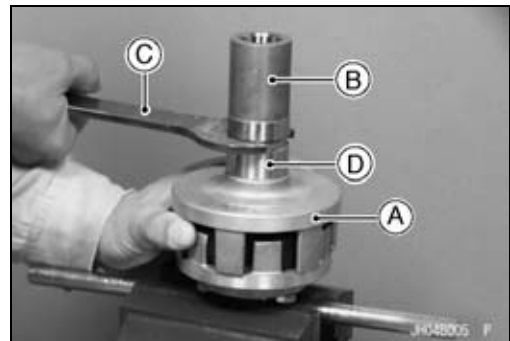
- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Crankshaft Sensor Cover (see Electrical System chapter)
- Holding the timing rotor, unscrew the coupling.

**Special Tools - Flywheel & Pulley Holder: 57001-1605 [A]
Holder Attachment: 57001-1547 [B]
Coupling Holder #2: 57001-1423 [C]**

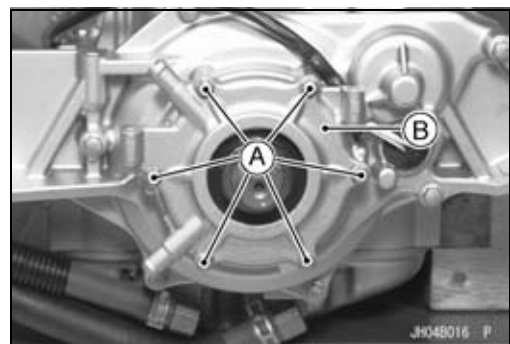


- ★ If the coupling [A] and output shaft [B] removed together, holding the coupling, unscrew the output shaft with the output shaft wrench [C].
Collar [D]

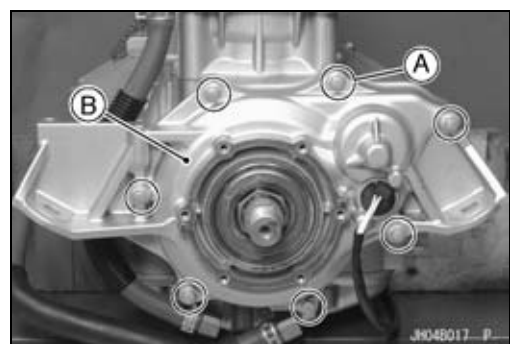
Special Tool - Output Shaft Wrench, Hex 36: 57001-1550



- Remove:
 - Output Cover Bolts [A]
 - Output Cover [B]

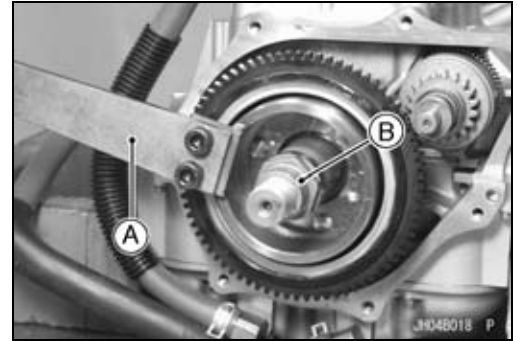


- Remove:
 - Magneto Cover Bolts [C]
 - Magneto Cover



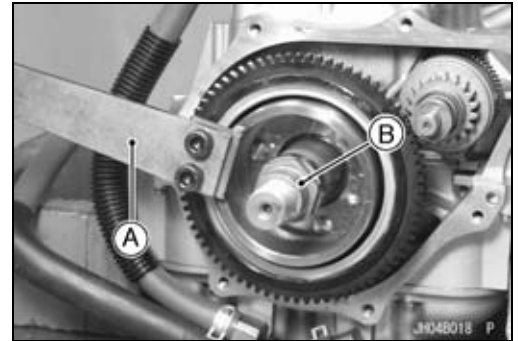
Coupling

- Using the rotor holder [A], remove the output shaft [B].
Special Tool - Rotor Holder: 57001-1544

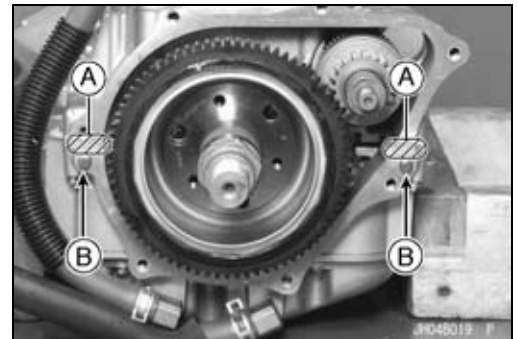


Coupling/Output Shaft Installation

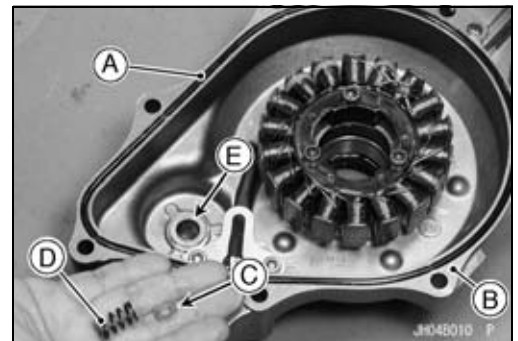
- Apply molybdenum disulfide oil solution to the seating surface of the output shaft.
- Using the rotor holder [A], install the output shaft [B].
Special Tool - Rotor Holder: 57001-1544
Torque - Output Shaft: 245 N·m (25.0 kgf·m, 180 ft·lb)



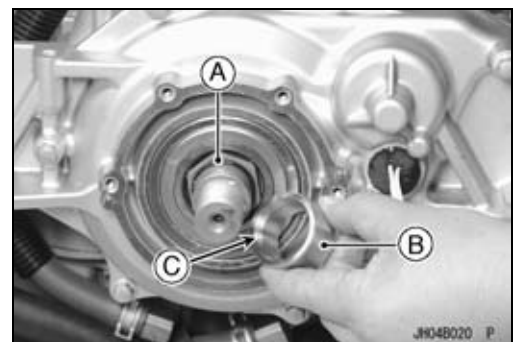
- Apply silicone sealant [A] to the crankcase halves mating surfaces on the magneto cover.
- Be sure to install the dowel pins [B].



- Apply grease to the O-ring [A], and fit the O-ring onto the groove of the magneto cover [B].
- Install the magneto cover.
- Be sure to install the washer [C] and the spring [D] into the hole [E] of the bushing.
- Torque - Magneto Cover Bolts: 20 N·m (2.0 kgf·m, 14 ft·lb)**



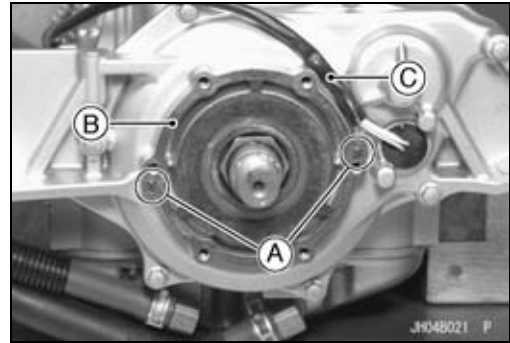
- Apply grease to the O-ring [A] and collar inside.
- Install the collar [B] so that the chamfer side [C] faces inward.



8-10 ENGINE BOTTOM END

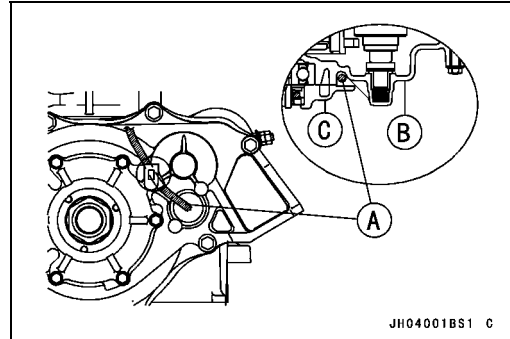
Coupling

- Install:
 - Pins [A]
 - Gasket [B]
- Position the magnet lead [C] as shown.



- Apply grease to the oil seal lip.
- Install the output cover.
- Run the magneto lead [A] between the magneto cover [B] and the output cover [C] as shown.

Torque - Output Cover Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)



- Install the coupling damper to the coupling.
- Holding the timing rotor, screw the coupling onto the output shaft and tighten it.

Special Tools - Flywheel & Pulley Holder: 57001-1605

Holder Attachment: 57001-1547

Coupling Holder #2: 57001-1423

Torque - Coupling: 98 N·m (10.0 kgf·m, 72 ft·lb)

- Install:
 - Crankshaft Sensor Cover
 - Engine (see Engine Removal/Installation chapter)

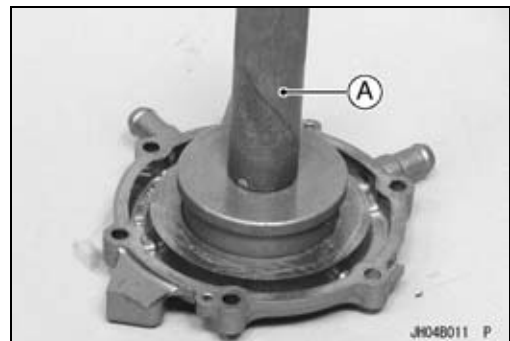
Coupling Damper Inspection

- Refer to Coupling Damper Inspection in the Periodic Maintenance chapter.

Output Cover Oil Seal Replacement

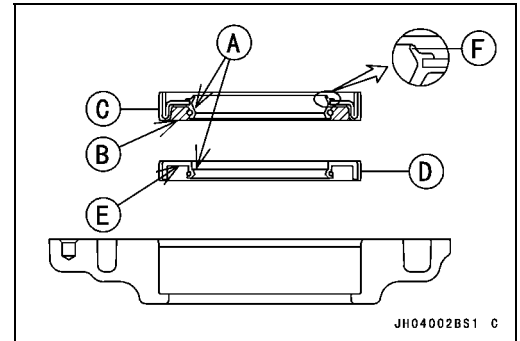
- Remove:
 - Output Cover (see Coupling/Output Shaft Removal)
- Using the bearing driver [A], remove the oil seals as a set.

Special Tool - Bearing Driver Set: 57001-1129



Coupling

- Replace the oil seals with new ones.
- Apply thin coat grease to the oil seal lips [A].
- Pack grease [B] between the oil seal lip and housing of the oil seal (flywheel side oil seal [C]).
- Press in the oil seals until they are bottomed.
- Install the coupling oil seal [D] so that the manufacturer's marks [E] face coupling side.
- Install the flywheel side oil seal so that the dust seal [F] side face out.



Oil Seal Inspection

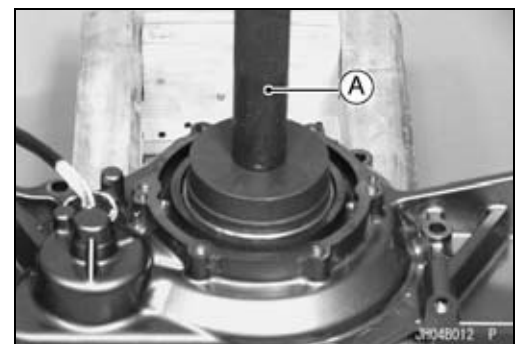
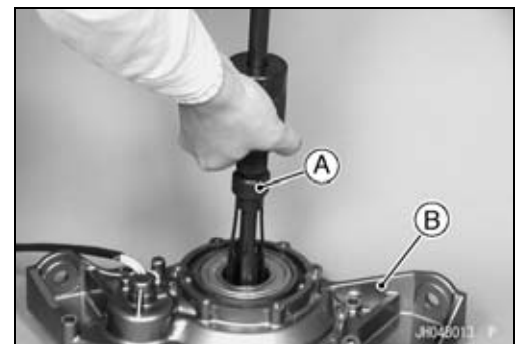
- Inspect the oil seal.
- Replace it if the lips are misshapen, discolored (indicating that the rubber has deteriorated), hardened or otherwise damaged.

Magneto Cover Bearing Replacement

CAUTION

Do not remove the ball bearing unless it is necessary. Removal may damage it.

- Remove:
 - Magneto Cover (see Coupling/Output Shaft Removal)
- Using the oil seal and bearing remover [A], remove the ball bearing from the magneto cover [B].
- When removing the ball bearing, hold the magneto cover.
- Special Tool - Oil Seal and Bearing Remover: 57001-1058**
- Using a press and the bearing driver set [A], install the new bearing until it stops at the bottom of its housing.
- Special Tool - Bearing Driver Set: 57001-1129**



Ball Bearing Lubrication

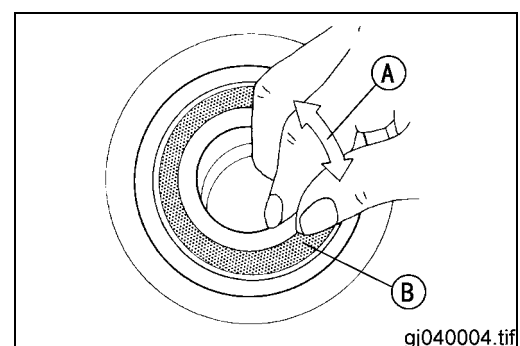
NOTE

- Since the bearings are packed with grease and sealed on both sides, lubrication is not required.

Ball Bearing Inspection

NOTE

- It is not necessary to remove the bearings for inspection. If the bearing is removed, it will need to be replaced with a new one.
- Spin [A] it by hand to check its condition.
- ★ If it is noisy, does not spin smoothly, or has any rough spots, it must be replaced.
- Examine the bearing seal [B] for tears or leakage.
- ★ If the seal is torn or is leaking, replace the bearing.



8-12 ENGINE BOTTOM END

Magneto Flywheel

Magneto Flywheel Removal

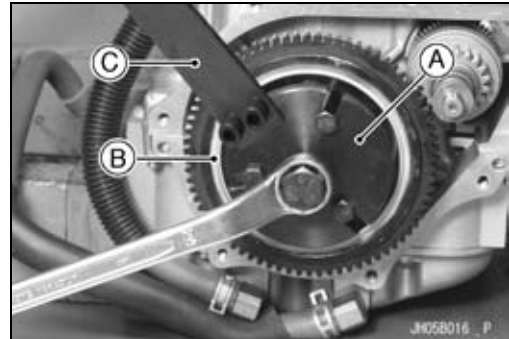
- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Crankshaft Sensor Cover (see Electrical System chapter)
 - Coupling (see Coupling/Output Shaft Removal)
 - Magneto Cover (see Coupling/Output Shaft Removal)

○ Using the rotor puller [A], pull off the flywheel [B].

Special Tool - Rotor Puller: 57001-1623
Grip: 57001-1591 [C]

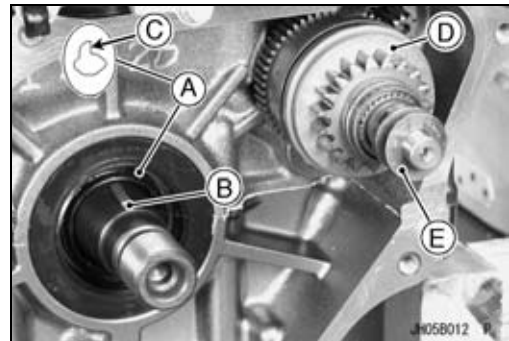
CAUTION

Do not hit the head of the rotor puller. A loss in rotor magnetism may be caused.



Magneto Flywheel Installation

- Using a high-flash points solvents, clean off any oil or dirt that may be on the crankshaft taper, and in the tapered hole in the magneto flywheel.
- Install the O-ring [A] directly as shown.
- This face [C] is magneto flywheel side.
- Fit the woodruff key [B] securely in the crankshaft before installing the magneto flywheel.
- ★ If the reduction gear [D] is removed, apply a molybdenum disulfide grease to both ends of its shaft.
- Install the reduction gear and the washer [E].



Magneto Flywheel

- Apply grease to the boss outside [A] of the magneto flywheel [B].
10 mm (0.39 in.) [C]
- Install the magneto flywheel.

NOTE

- Confirm the magneto flywheel fit or not to the crankshaft before tightening it with specified torque.
- Install the output shaft and tighten it with 70 N·m (7.0 kgf·m, 52 ft·lb) of torque.
- Remove the output shaft.
- Check the tightening torque with rotor puller.

Special Tool - Rotor Puller: 57001-1623

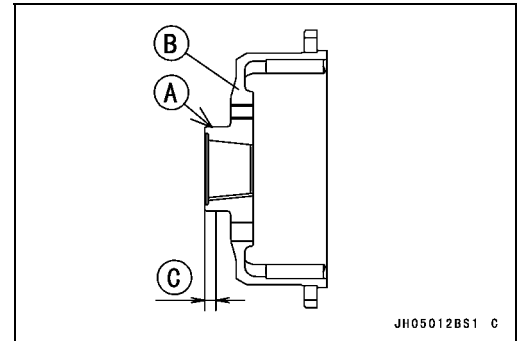
Grip: 57001-1591

- ★ If the magneto flywheel is not pulled out with 20 N·m (2.0 kgf·m, 52 ft·lb) of drawing torque, it is installed correctly.
- ★ If the magneto flywheel is pulled out with under 20 N·m (2.0 kgf·m, 52 ft·lb) of drawing torque, clean off any oil dirt or flaw of the crankshaft and magneto flywheel tapered portion, and dry them with a clean cloth. Then, confirm that it is not pulled out with above torque.
- Tighten the output shaft while holding the magneto flywheel steady with the rotor holder.

Special Tool - Rotor Holder: 57001-1544

Torque - Output Shaft: 245 N·m (25 kgf·m, 180 ft·lb)

- Install:
Magneto Cover (see Coupling/Output Shaft Installation)

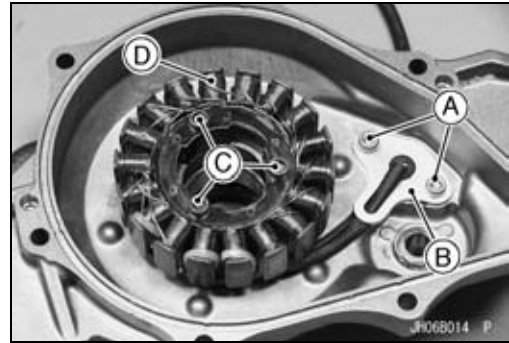


8-14 ENGINE BOTTOM END

Stator

Stator Removal

- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Magneto Cover (see Coupling/Output Shaft Removal)
 - Grommet Cover Mounting Bolts [A]
 - Grommet Cover [B]
 - Stator Mounting Bolts [C] with Washers
 - Stator Assembly [D]



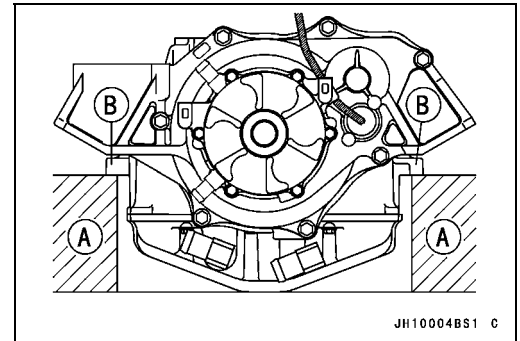
Stator Installation

- Apply water resistant grease to the outside of the grommet.
 - Apply a non-permanent locking agent to the grommet cover bolts.
 - Tighten:
 - Torque - Grommet Cover Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
 - Apply a non-permanent locking agent to the stator mounting bolts and put the washers.
 - Tighten:
 - Torque - Stator Mounting Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)**
- When installing the stator, fix the stator lead to the groove of the magneto cover.
- Be sure to the stator lead have no slack and bite.

Crankcase Splitting

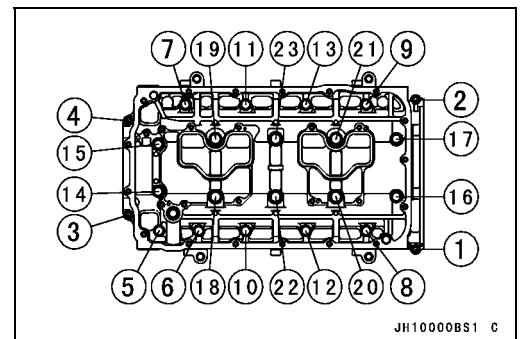
Crankcase Splitting

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Engine (see Engine Removal/Installation chapter).
- Drain the engine oil (see Periodic Maintenance chapter).
- Set the engine on a clean surface and hold the engine steady while parts are being removed.
 - Suitable Props [A]
 - Lower Crankcase Projections [B]

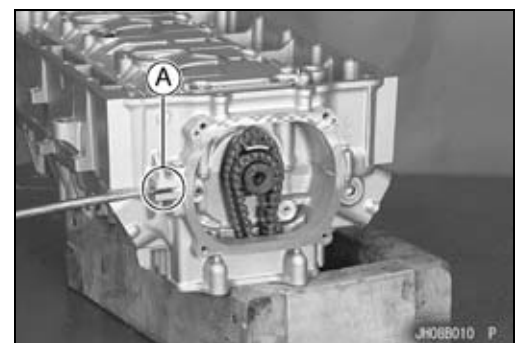
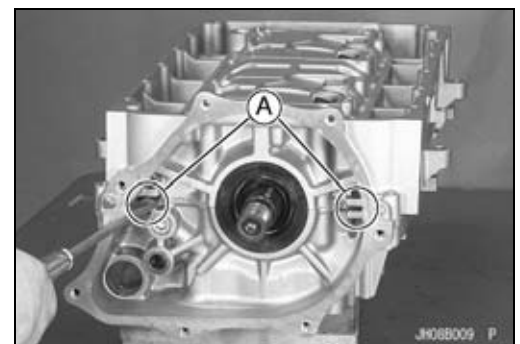


- Remove:
 - Crankshaft Sensor Cover (see Electrical System chapter)
 - Cylinder Head (see Engine Top End chapter)
 - Piston (see Engine Top End chapter)
 - Starter Motor (see Electrical System chapter)
 - Oil Pump Bodies (see Engine Lubrication System chapter)
 - Magneto Flywheel (see Magneto Flywheel Removal)
 - Oil Filter (see Periodic Maintenance chapter)

- Remove the crankcase bolts.
 - First loosen the M6 bolts [1 ~ 4].
 - Next loosen the M8 bolts [5 ~ 17].
 - Last loosen the M10 bolts [18 ~ 23].



- Using the pry points [A], split the crankcase halves.
- Lift off the lower crankcase half.



8-16 ENGINE BOTTOM END

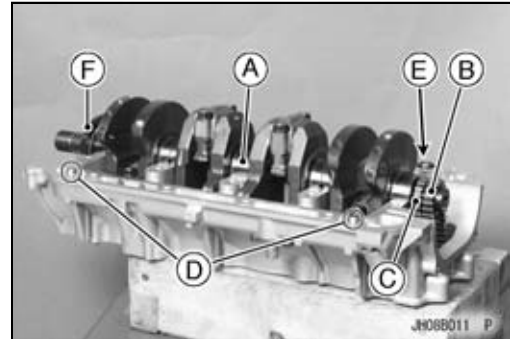
Crankcase Splitting

Crankcase Assembly

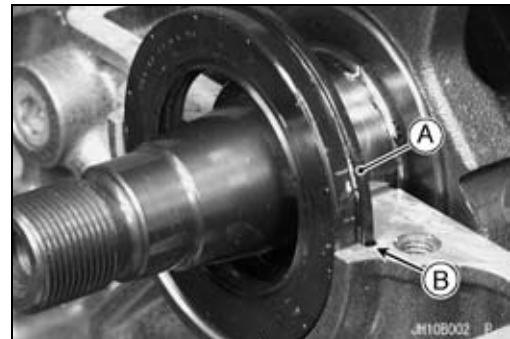
CAUTION

The upper and lower crankcase halves are machined at the factory in the assembled state, so the crankcase halves must be replaced as a set.

- With high-flash point solvent, clean off the mating surfaces of the crankcases halves and wipe dry.
- Using compressed air, blow out the oil passages in the crankcase halves.
- Install:
 - Crankshaft [A] and Connecting Rods (see Crankshaft Installation)
 - Camshaft Chain [B]
 - Oil Pump Sprocket Chain [C]
 - Dowel Pins [D]
 - Oil Passage Pipe [E] with O-ring
 - Oil Seal [F]



- Before fitting the lower case on the upper case, check the following.
 - Be sure to hang the camshaft and oil pump sprocket chain on the crankshaft.
 - Check to see that the oil seal [A] is in the groove [B] of the crankcase.

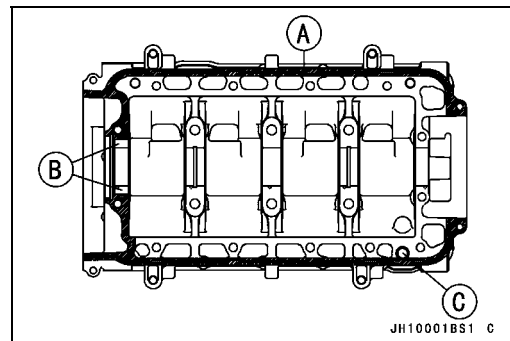


- Apply liquid gasket [A] to the mating surface of the lower crankcase half.

NOTE

- Make the application finish within 30 minutes when the liquid gasket to the mating surface of the lower crankcase half is applied.
- Moreover fit the case and tighten the case bolts just after finishing the application of the liquid gasket.

Sealant - Kawasaki Bond: 92104-1062

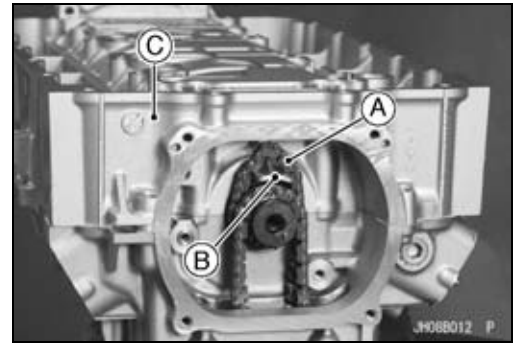


CAUTION

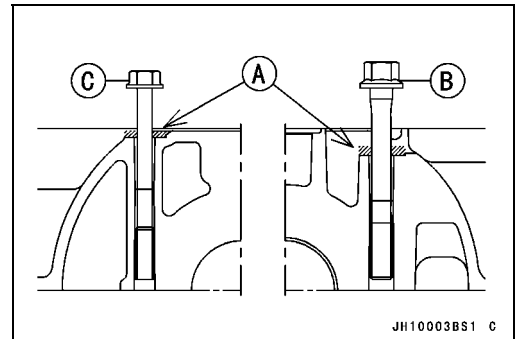
Do not apply liquid gasket around the crankshaft main bearing inserts [B], and oil passage hole [C].

Crankcase Splitting

- Install the oil pump sprocket chain [A] on the chain guide [B] of the lower crankcase [C].



- Apply molybdenum disulfide oil solution to the bolt seating surfaces [A] on the lower crankcase for the M10 bolts [B] and M8 [7 ~ 10] bolts [C].



- Tighten the crankcase bolts.
 - Following the sequence numbers on the lower crankcase half, tighten the M10 bolts [1 ~ 6].

Torque - Crankcase Bolts (M10): 50 N·m (5.0 kgf·m, 36 ft·lb)

- Following the sequence numbers, tighten the M8 bolts [7 ~ 10].

Torque - Crankcase Bolts (M8): 29 N·m (3.0 kgf·m, 22 ft·lb)

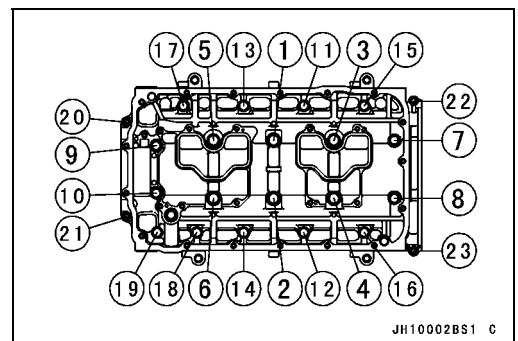
- Following the sequence numbers, tighten the M8 bolts [11 ~ 19].

Torque - Crankcase Bolts (M8): 29 N·m (3.0 kgf·m, 22 ft·lb)

- Following the sequence numbers, tighten the M7 bolts [20 ~ 23].

Torque - Crankcase Bolts (M6): 12 N·m (1.2 kgf·m, 104 in·lb)

- After tightening all crankcase bolts, check the following item.
 - Crankshaft turn freely.

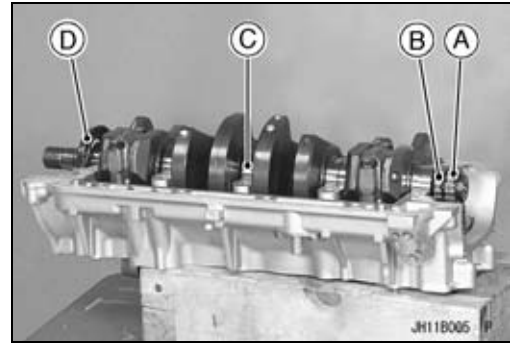


8-18 ENGINE BOTTOM END

Crankshaft and Connecting Rods

Crankshaft Removal

- Split the crankcase (see Crankcase Splitting).
- Remove:
 - Camshaft Chain [A]
 - Oil Pump Sprocket Chain [B]
- Remove the crankshaft [C] with the oil seal [D].



Crankshaft Installation

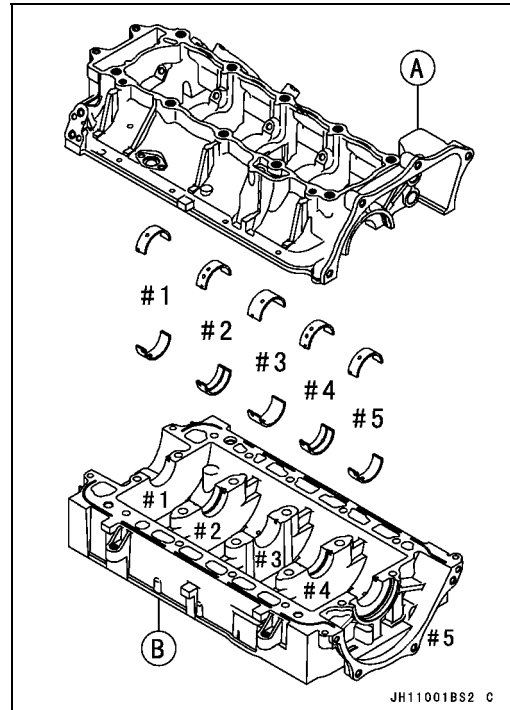
CAUTION

If the crankshaft, bearing inserts, or crankcase halves are replaced with new ones, select the bearing inserts and check clearance with a plastigage before assembling engine to be sure the correct bearing inserts are installed.

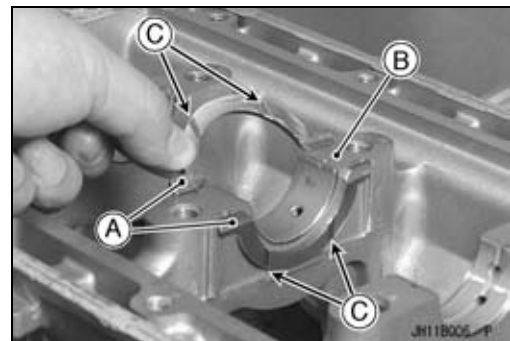
- Fit the crankshaft main bearing inserts on the upper [A] and lower [B] crankcase halves.
 - #1, 5 Bearing Inserts (no Groove, same)
 - #2, 4 Bearing Inserts (Groove, same)
 - #3 Bearing Insert (no Groove)

NOTE

- Be sure the bearing inserts are seated in the saddles, and the tangs in the bearing inserts are aligned with the notches in the saddles.
- Apply molybdenum disulfide oil solution to the crankshaft main bearing inserts.

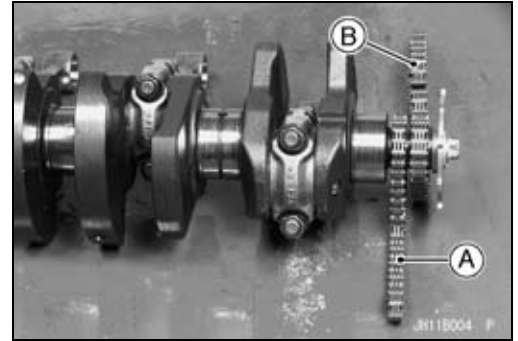


- Fit the thrust washers [A] to both sides of the upper crankcase #3 main bearing [B].
 - Install the thrust washer so that the oil grooves [C] face outward.

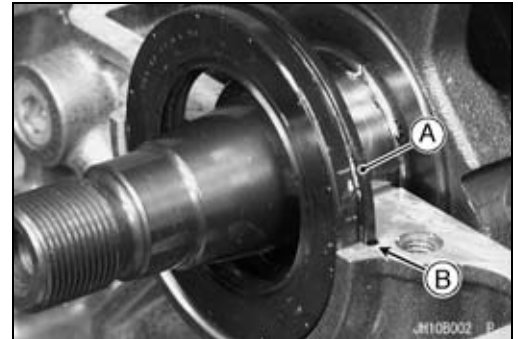


Crankshaft and Connecting Rods

- Install the crankshaft with the oil pump sprocket chain [A] and camshaft chain [B] hanging on them.



- Fit the oil seal [A] into the groove [B] of the crankcase.
- Assemble the crankcase (see Crankcase Assembly).



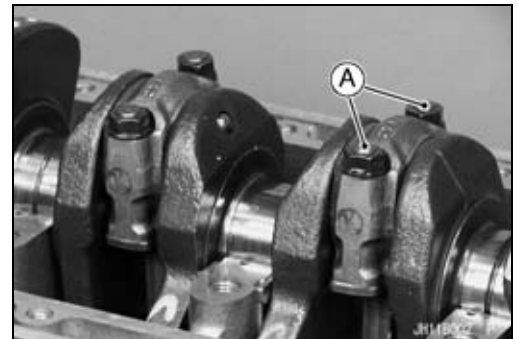
Connecting Rod Removal

- Split the crankcase (see Crankcase Splitting).
- Remove the connecting rod nuts [A].
- Remove the crankshaft.

NOTE

○Mark and record the locations of the connecting rods and their big end caps so that they can be reassembled in their original positions.

- Remove the connecting rods from the crankshaft.



Connecting Rod Installation

⚠ WARNING

Clean the crankshaft, bolts, nuts, and connecting rods in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area. This includes any appliance with a pilot light. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvents to clean them.

- After removing the connecting rods from the crankshaft, clean them with high-flash point solvent.
- Blow the crankshaft oil passages with compressed air to remove any foreign particles or residue that may have accumulated in the passages.

8-20 ENGINE BOTTOM END

Crankshaft and Connecting Rods

CAUTION

To minimize vibration, the connecting rods should have the same weight mark.

Big End Cap [A]
Connecting Rod [B]
Weight Mark, Alphabet [C]
Diameter Mark [D]

- ★ If the connecting rods, big end bearing inserts, or crankshaft are replaced with new ones, select the bearing insert and check clearance with a plastigage before assembling engine to be sure the correct bearing inserts are installed.

CAUTION

The connecting rod bolts are designed to stretch when tightened. Never reuse them. See the table below for correct bolt and nut usage.

- Apply grease and oil to the following portions.
Apply molybdenum disulfide grease [A].
Do not apply grease and oil [B].
Apply molybdenum disulfide oil solution [C].

CAUTION

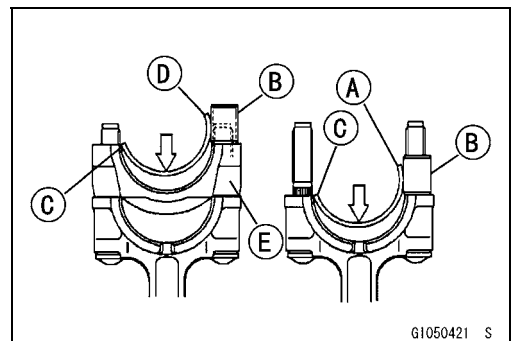
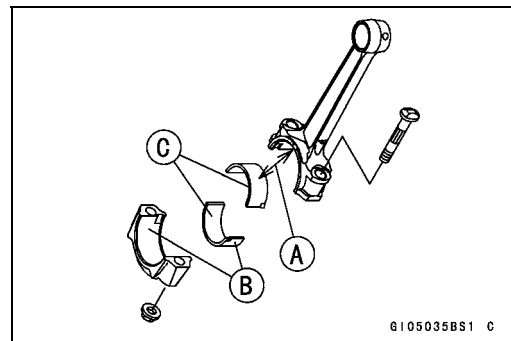
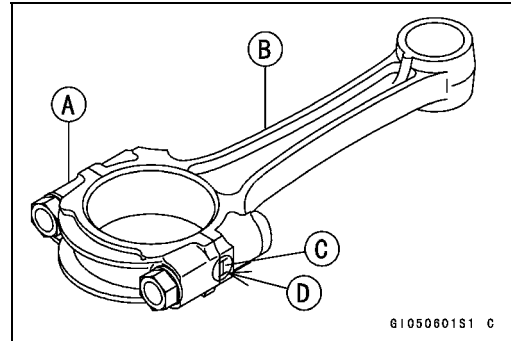
Do not apply grease to the inner surface of the lower big end cap or to the outer surface of the lower bearing insert.

- Install the bearing insert as shown to prevent its outer surface from scratch damage with connecting rod edge.
Connecting Rod Side Bearing Insert [A]
Dowel Pin [B]
Claw Side [C]
Cap Side Bearing Insert [D]
Connecting Rod Cap [E]

- Replace the connecting rod big end bolts and nuts with new ones.
- Be sure to clean the bolts, nuts, and connecting rods thoroughly with high-flash point solvent, because the new connecting rods, bolts, and nuts are treated with anti-rust solution.

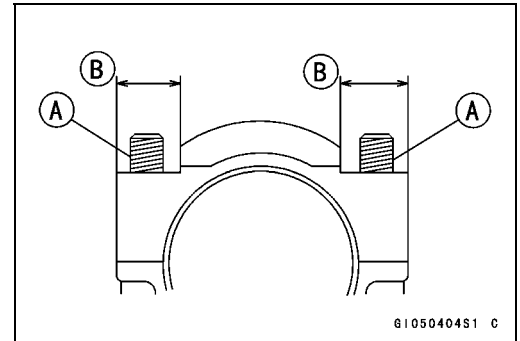
CAUTION

Immediately dry the bolts and nuts with compressed air after cleaning.
Clean and dry the bolts and nuts completely.

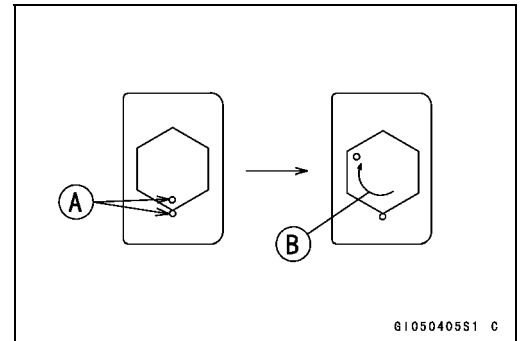


Crankshaft and Connecting Rods

- Apply small amount of molybdenum disulfide oil solution to the threads [A] and seating surfaces [B] of the connecting rod nuts.



- First, tighten the nuts to the specified torque. See the table below.
- Next, tighten the nuts by **120°** more.
- Mark [A] the connecting rod big end caps and nuts so that nuts can be turned 120° [B] properly.
- Tighten the hexagon nut by 2 corners.



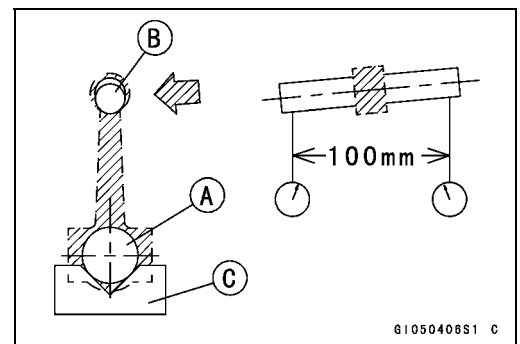
Connecting Rod Assy	Bolt, Nut	Torque + Angle N·m (kgf·m, ft·lb)
New	Use the bolts and nuts attached to new con-rod. Another new bolts and nuts.	21.6 (2.2, 16) + 120°
Used	Replace the bolts and nuts with new ones	21.6 (2.2, 16) + 120°

CAUTION

Be careful not to overtighten the nuts.

Connecting Rod Bend

- Remove the connecting rod big end bearing inserts, and reinstall the connecting rod big end caps.
 - Select an arbor [A] of the same diameter as the connecting rod big end, and insert the arbor through the connecting rod big end.
 - Select an arbor of the same diameter as the piston pin at least 100 mm (3.94 in.) long, and insert the arbor [B] through the connecting rod small end.
 - On a surface plate, set the big-end arbor on V blocks [C].
 - Measure the difference in the heights of the arbor above the surface plate over a 100 mm (3.94 in.) distance on the arbor to determine the amount of connecting rod bend with the connecting rod held vertically, and using a height gauge.
- ★ If connecting rod bend exceeds the service limit, the connecting rod must be replaced.



Connecting Rod Bend

Service Limit: 0.2/100 mm (0.008/3.94 in.)

8-22 ENGINE BOTTOM END

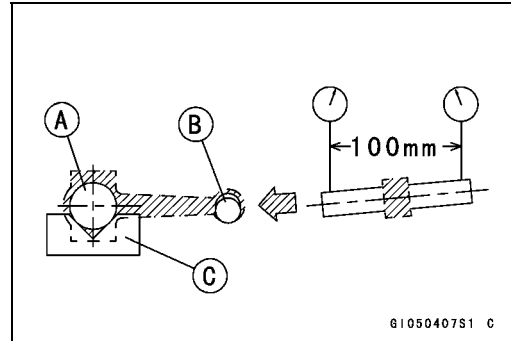
Crankshaft and Connecting Rods

Connecting Rod Twist

- On surface plate, set the big-end arbor [A] on V block [C].
- Measure the difference in the heights of the arbor [B] above the surface plate over a 100 mm (3.94 in.) distance on the arbor to determine the amount of connecting rod twist with the connecting rod held horizontally, and using a height gauge.
- ★ If connecting rod twist exceeds the service limit, the connecting rod must be replaced.

Connecting Rod Twist

Service Limit: 0.2/100 mm (0.008/3.94 in.)



Connecting Rod Big End Side Clearance

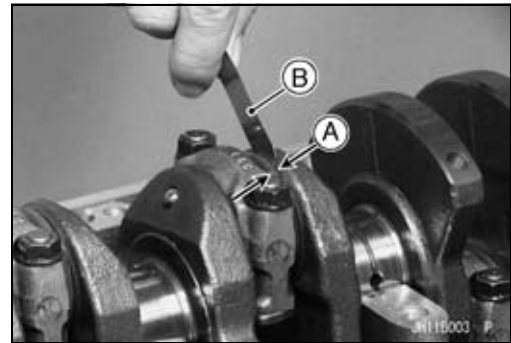
- Measure connecting rod big end side clearance [A].
- Insert a thickness gauge [B] between the big end and either crank web to determine clearance.

Connecting Rod Big End Side Clearance

Standard: 0.13 ~ 0.38 mm (0.0051 ~ 0.0150 in.)

Service Limit: 0.58 mm (0.023 in.)

- ★ If the clearance exceeds the service limit, replace the connecting rod with a new one and then check clearance again. If clearance is too large after connecting rod replacement, the crankshaft also must be replaced.

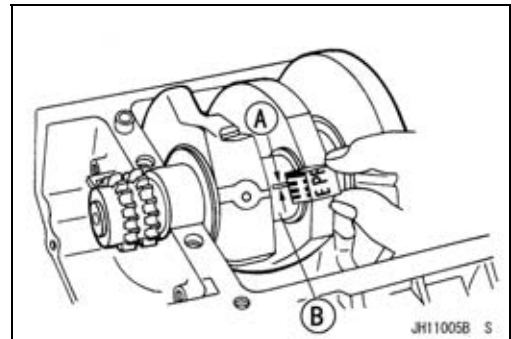


Connecting Rod Big End Bearing Insert/Crankpin Wear

- Measure the bearing insert/crankpin [B] clearance with a plastigage [A].

NOTE

- Tighten the connecting rod big end nuts to the specified torque (see Connecting Rod Installation).
- Do not move the connecting rod and crankshaft during clearance measurement.



Connecting Rod Big End Bearing Insert/Crankpin Clearance

Standard: 0.041 ~ 0.071 mm (0.0016 ~ 0.00280 in.)

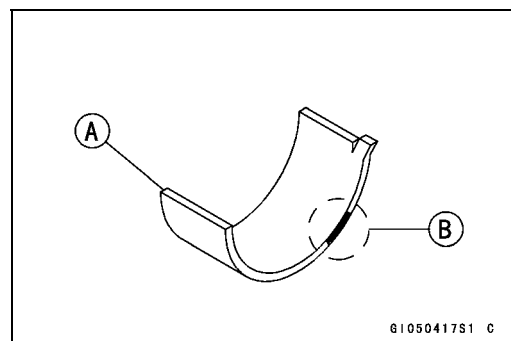
Service Limit: 0.11 mm (0.0043 in.)

- ★ If clearance is within the standard, no bearing replacement is required.
- ★ If clearance is between 0.072 mm (0.00284 in.) and the service limit (0.11 mm, 0.0043 in.), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/crankpin clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.
- ★ If the clearance exceeds the service limit, measure the diameter of the crankpins.

Crankpin Diameter

Standard: 38.984 ~ 39.000 mm (1.5348 ~ 1.5354 in.)

Service Limit: 38.97 mm (1.534 in.)



Crankshaft and Connecting Rods

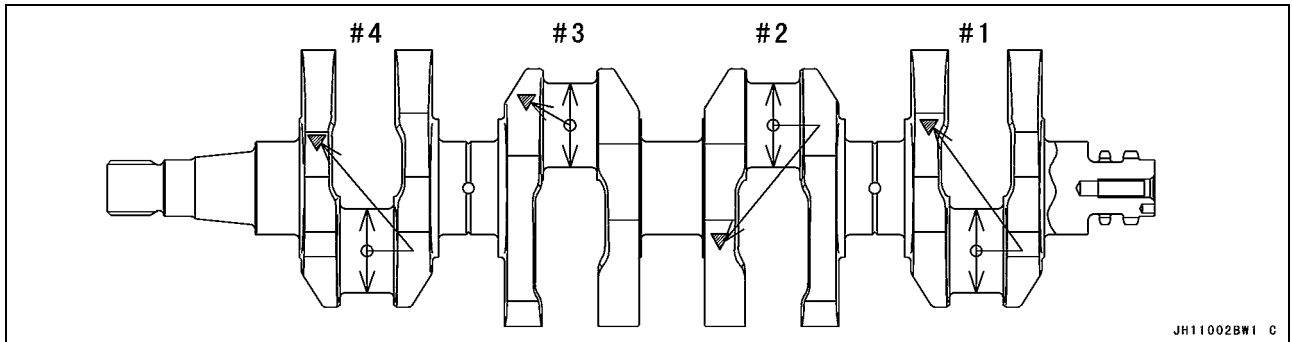
- ★ If any crankpin has worn past the service limit, replace the crankshaft with a new one.
- ★ If the measured crankpin diameters are not less than the service limit, but do not coincide with the original diameter markings on the crankshaft, make new marks on it.

Crankpin Diameter Marks

None 38.984 ~ 38.992 mm (1.5348 ~ 1.5351 in.)

○ 38.993 ~ 39.000 mm (1.5352 ~ 1.5354 in.)

Δ: Crankpin Diameter Marks, “○” mark or no mark.



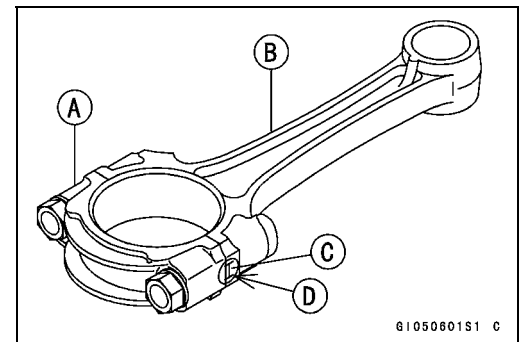
- Measure the connecting rod big end bore diameter, and mark each connecting rod big end in accordance with the bore diameter.

Big End Cap [A]

Connecting Rod [B]

Weight Mark [C]: A letter of the alphabet

Bore Diameter Mark (Around Weight Mark) [D]: “○” or no mark.



NOTE

- Tighten the connecting rod big end nuts to the specified torque (see *Connecting Rod Installation*).
- The mark already on the big end should almost coincide with the measurement.

Connecting Rod Big End Bore Diameter Marks

None 42.000 mm ~ 42.008 mm (1.6535 ~ 1.65386 in.)

○ 42.009 ~ 42.016 mm (1.65389 ~ 1.6542 in.)

- Select the proper bearing insert in accordance with the combination coding of the connecting rod and crankshaft.
- Install the new inserts in the connecting rod and check insert/crankpin clearance with the plastigage.

Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92139-3710
None	None	Black	92139-3709
○	○		
○	None	Blue	92139-3708

8-24 ENGINE BOTTOM END

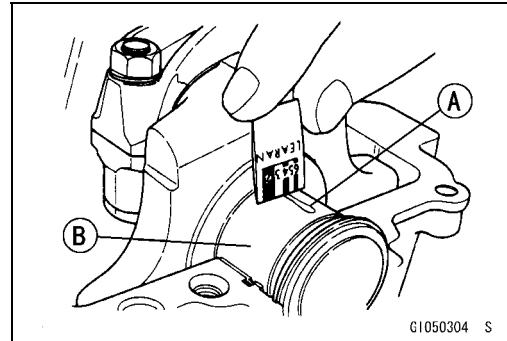
Crankshaft and Connecting Rods

Crankshaft Main Bearing Insert/Journal Wear

- Measure the bearing insert/journal [B] clearance with a plastigage [A].

NOTE

- Tighten the crankcase bolts to the specified torque (see Crankcase Assembly).
- Do not turn the crankshaft during clearance measurement.
- Journal clearance less than 0.025 mm (0.0010 in.) can not be measured by plastigage, however, using genuine parts maintains the minimum standard clearance.

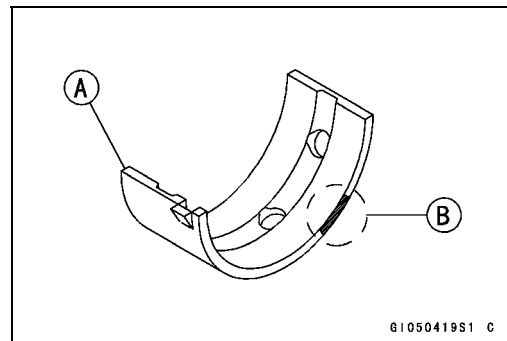


Crankshaft Main Bearing Insert/Journal Clearance

Standard: 0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in.)

Service Limit: 0.08 mm (0.0032 in.)

- ★ If clearance is within the standard, no bearing replacement is required.
- ★ If clearance is between 0.055 mm (0.022 in.) and the service limit (0.08 mm, 0.0032 in.), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/journal clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.
- ★ If clearance exceeds the service limit, measure the diameter of the crankshaft main journal.



Crankshaft Main Journal Diameter

Standard: 40.984 ~ 41.000 mm (1.6135 ~ 1.6142 in.)

Service Limit: 40.96 mm (1.613 in.)

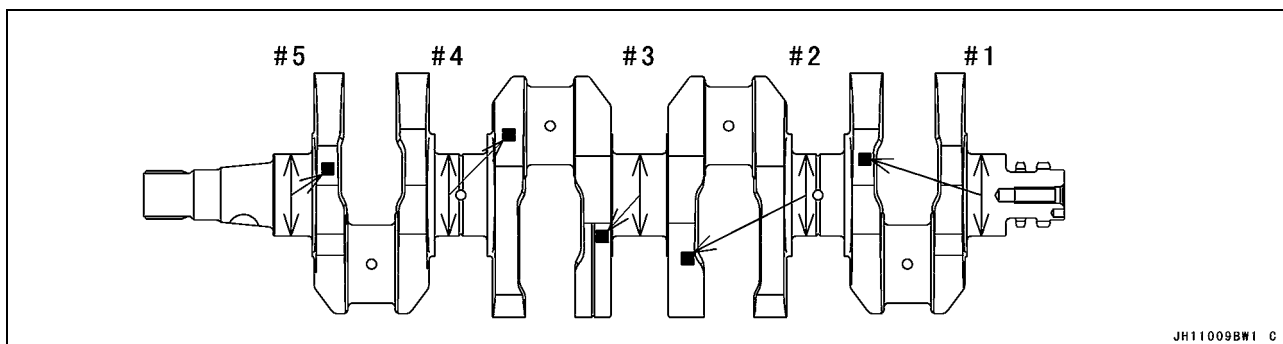
- ★ If any journal has worn past the service limit, replace the crankshaft with a new one.
- ★ If the measured journal diameters are not less than the service limit, but do not coincide with the original diameter markings on the crankshaft, make new marks on it.

Crankshaft Main Journal Diameter Marks

None 40.984 ~ 40.992 mm (1.6135 ~ 1.61385 in.)

1 40.993 ~ 41.000 mm (1.61389 ~ 1.6142 in.)

- : Crankshaft Main Journal Diameter Marks, "1" mark or no mark.



Crankshaft and Connecting Rods

- Measure the main bearing bore diameter, and mark [B] the upper crankcase half [A] in accordance with the bore diameter.
- Crankcase main bearing bore diameter marks are "○" mark and no mark.

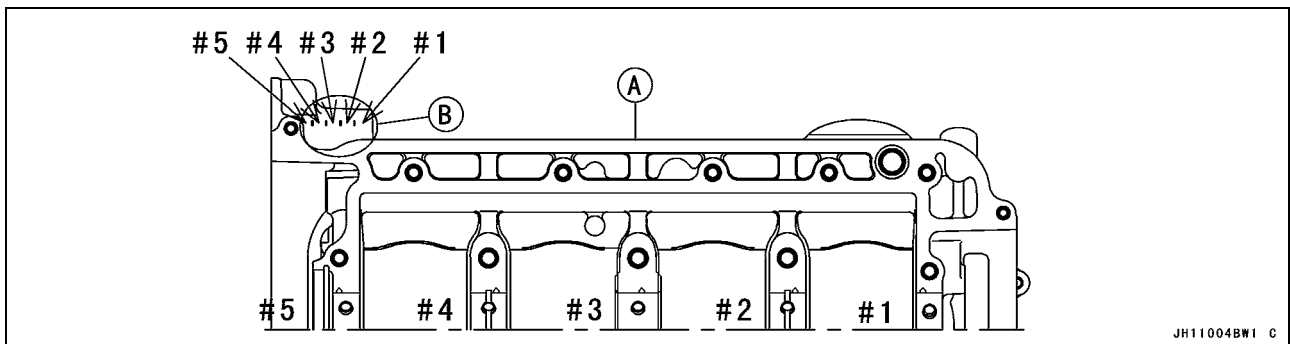
NOTE

- Tighten the crankcase bolts to the specified torque (see Crankcase Assembly).
- The mark already on the upper crankcase half should almost coincide with the measurement.

Crankcase Main Bearing Bore Diameter Marks

- 44.000 ~ 44.008 mm (1.7323 ~ 1.73259 in.)
- None 44.009 ~ 44.016 mm (1.73263 ~ 1.7329 in.)

Marking Position



- Select the proper bearing insert in accordance with the combination coding of the crankcase and crankshaft.
- Install the new inserts in the crankcase halves and check insert/journal clearance with the plastigage.

Crankcase Main Bearing Bore Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert*		
		Size Color	Part Number	Journal No.
○	1	Brown	92139-3704	1, 5
			92139-3713	3
			92139-3707	2, 4
○	None	Black	92139-3703	1, 5
			92139-3712	3
None	1		92139-3706	2, 4
			None	None
92139-3711	3			
92139-3705	2, 4			

*The bearing inserts for Nos. 2 and 4 journals have an oil groove, respectively.

8-26 ENGINE BOTTOM END

Crankshaft and Connecting Rods

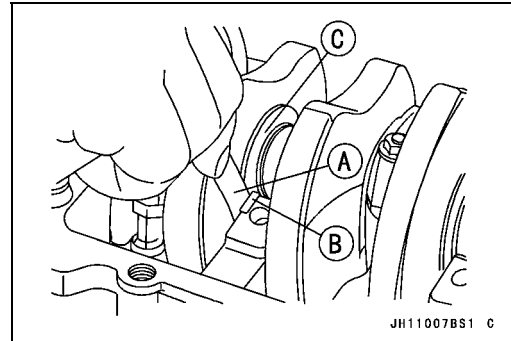
Crankshaft Side Clearance

- Insert a thickness gauge [A] between the thrust washer [B] and the crank web [C] at the No. 3 main journal to determine clearance.
- ★ If the clearance exceeds the service limit, replace the thrust washer as a set and check the width of the crankshaft #3 main journal.

Crankshaft Side Clearance

Standard: 0.05 ~ 0.24 mm (0.0020 ~ 0.0094 in.)

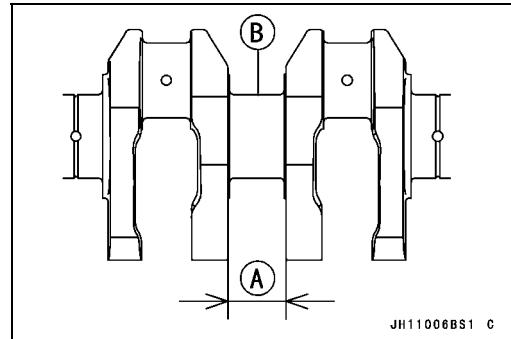
Service Limit: 0.44 mm (0.017 in.)



- Measure the crankshaft #3 main journal width [A].
- ★ If the measurement exceeds the standard, replace the crankshaft [B].

Crankshaft #3 Main Journal Width

Standard: 27.45 ~ 27.55 mm (1.0807 ~ 1.0846 in.)



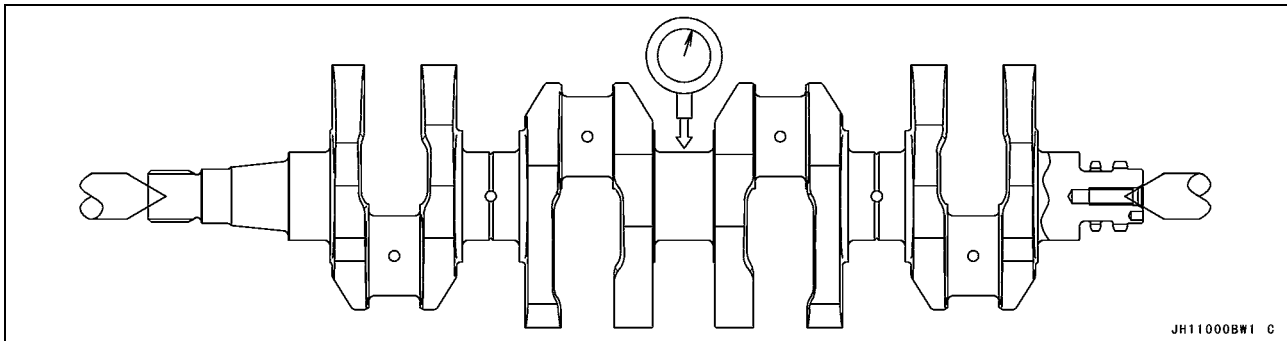
Crankshaft Runout

- Measure the crankshaft runout.
- ★ If the measurement exceeds the service limit, replace the crankshaft.

Crankshaft Runout

Standard: TIR 0.03 mm (0.0012 in.) or less

Service Limit: TIR 0.07 mm (0.0028 in.)



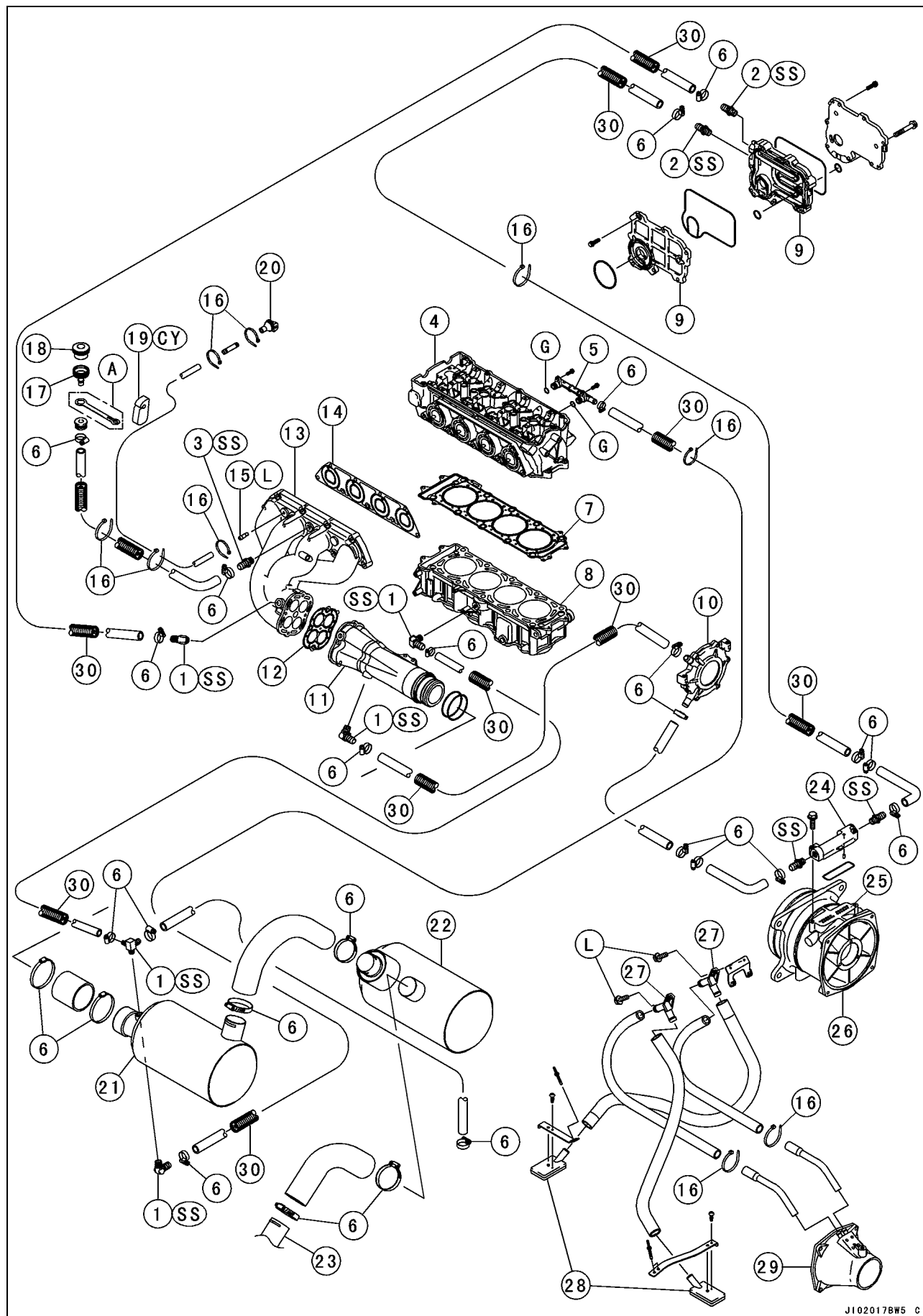
Cooling and Bilge Systems

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9-2 COOLING AND BILGE SYSTEMS

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Water Hose Joint (L Shape Type)	11	1.1	95 in·lb	SS
2	Water Hose Joint (Straight Shape Type)	20	2.0	14	SS
3	Water Hose Joint (Straight Shape Type)	11	1.1	95 in·lb	SS

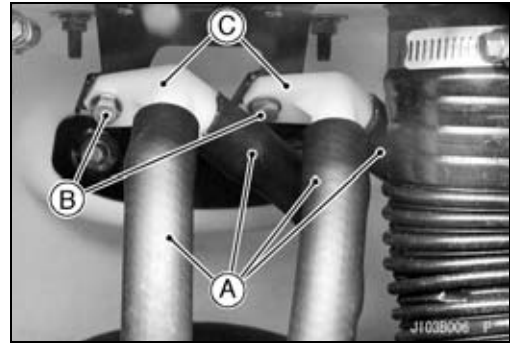
- 4. Cylinder Head
 - 5. Water Pipe
 - 6. Metal Clamp
 - 7. Cylinder Head Gasket
 - 8. Cylinder
 - 9. Oil Cooler
 - 10. Output Cover
 - 11. Exhaust Pipe
 - 12. Exhaust Pipe Gasket
 - 13. Exhaust Manifold
 - 14. Exhaust Manifold Gasket
 - 15. Bypass Outlet Nozzle
 - 16. Plastic Clamp
 - 17. Flushing Fitting
 - 18. Flushing Cap
 - 19. Detent
 - 20. Bypass Outlet
 - 21. Left Water Box Muffler
 - 22. Right Water Box Muffler
 - 23. Tail Pipe
 - 24. Cooling Water Filter Cover
 - 25. Cooling Water Filter
 - 26. Pump
 - 27. Bilge Breather
 - 28. Bilge Filter
 - 29. Pump Outlet
 - 30. Protective Tube
- A: JT1500-A2 Model ~
 CY: Apply cyanoacrylate cement.
 G: Apply grease.
 L: Apply a non-permanent locking agent.
 SS: Apply silicone sealant.

9-4 COOLING AND BILGE SYSTEMS

Bilge System

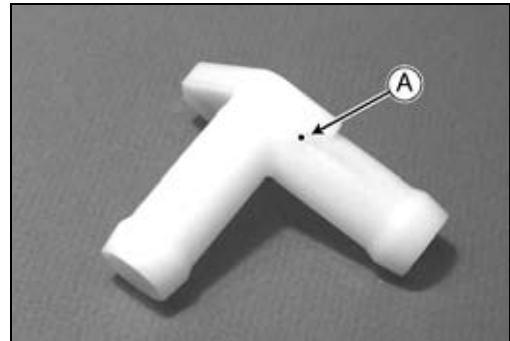
Breather Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Rear Storage Pocket
- Pull the hoses [A] off the breather.
- Unscrew the mounting bolts [B], and remove the breathers [C].



Breather Installation

- Be sure the small hole [A] in the breather is open before installing it.
- Apply a non-permanent locking agent to the breather mounting bolts and tighten them.



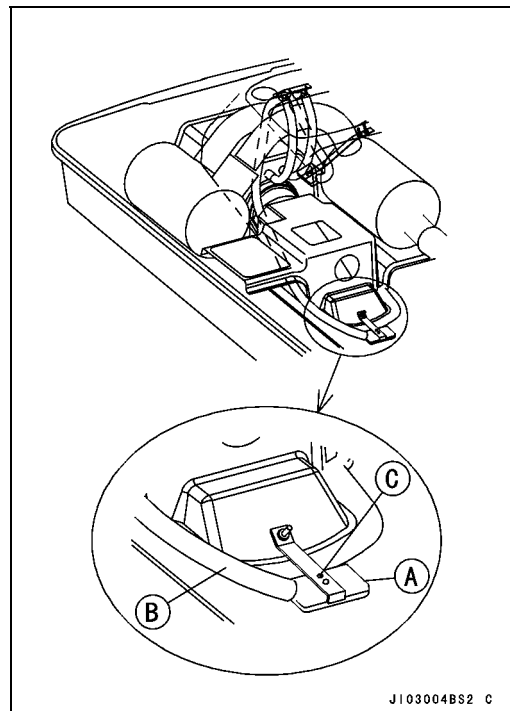
Breather Cleaning and Inspection

- Check that the small hole in the top of the breather is open by blowing in one end of the breather and plugging the other.
- ★ If the hole is plugged, clean it with compressed air. Do not open it with a pointed object (like a needle or a piece of wire), because the hole may be enlarged. If the hole is too large, the bilge system may not suck water out of the hull as it should.

Filter Removal

Follow the next procedures to remove the right side filter [A].

- Remove the engine (see Engine Removal/Installation chapter).
- Pull the hose [B] off the filter.
- Unscrew the mounting screw [C] and remove the filter.

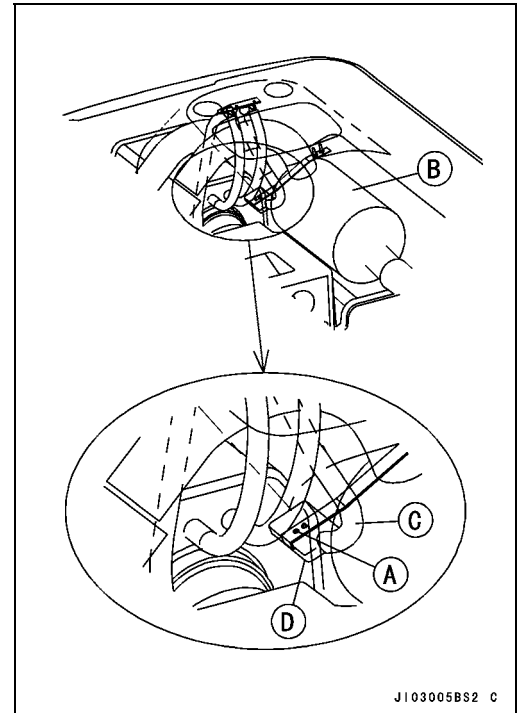


J103004BS2 C

Bilge System

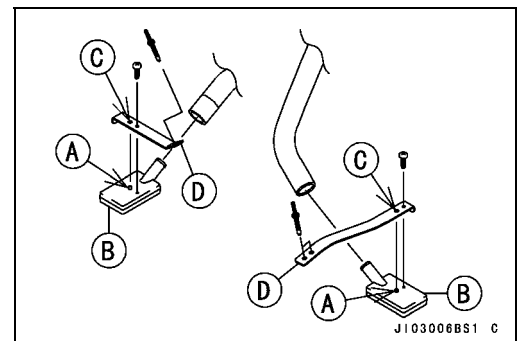
Follow the next procedures to remove the left side filter [D].

- Remove the water box muffler [B] (see Exhaust System chapter).
- Pull the hose [C] off the filter.
- Unscrew the mounting screw [A] and remove the filter.



Filter Installation

- Align the projections [A] on the filters [B] with the holes [C] on the brackets [D].



Filter Cleaning and Inspection

- Flush the filter thoroughly with fresh water and shake it dry.
- Water must flow freely through the filter, but large debris must not.
- ★ If the filter cannot be cleaned, or if it is broken and allows debris to pass through, replace it.

9-6 COOLING AND BILGE SYSTEMS

Cooling and Bilge System Hoses

Hose Removal

- The majority of bilge hoses have no clamps at the hose ends. The majority of bilge system hoses may be simply pulled off their fittings.

NOTE

○ *Some of the bilge system hoses have plastic clamps at hose ends.*

- All the cooling system hoses are clamped at both ends. Loosen the clamps and pull the hoses off.

Hose Installation

- To install the bilge filter hose, push the hose over the end of the filter.

NOTE

○ *Some of the bilge system hoses have plastic clamps at hose ends.*

- When installing the cooling system hoses, be sure to use the same kind of clamp as the original. Some of the clamps are metal for tighter clamping ability (required when smooth fittings are used). Plastic clamps are used where tight clamping is not required.

Hose Inspection

- Refer to Hose and Hose Connect Inspection in the Periodic Maintenance chapter.

Cooling and Bilge System Flushing

Cooling System Flushing

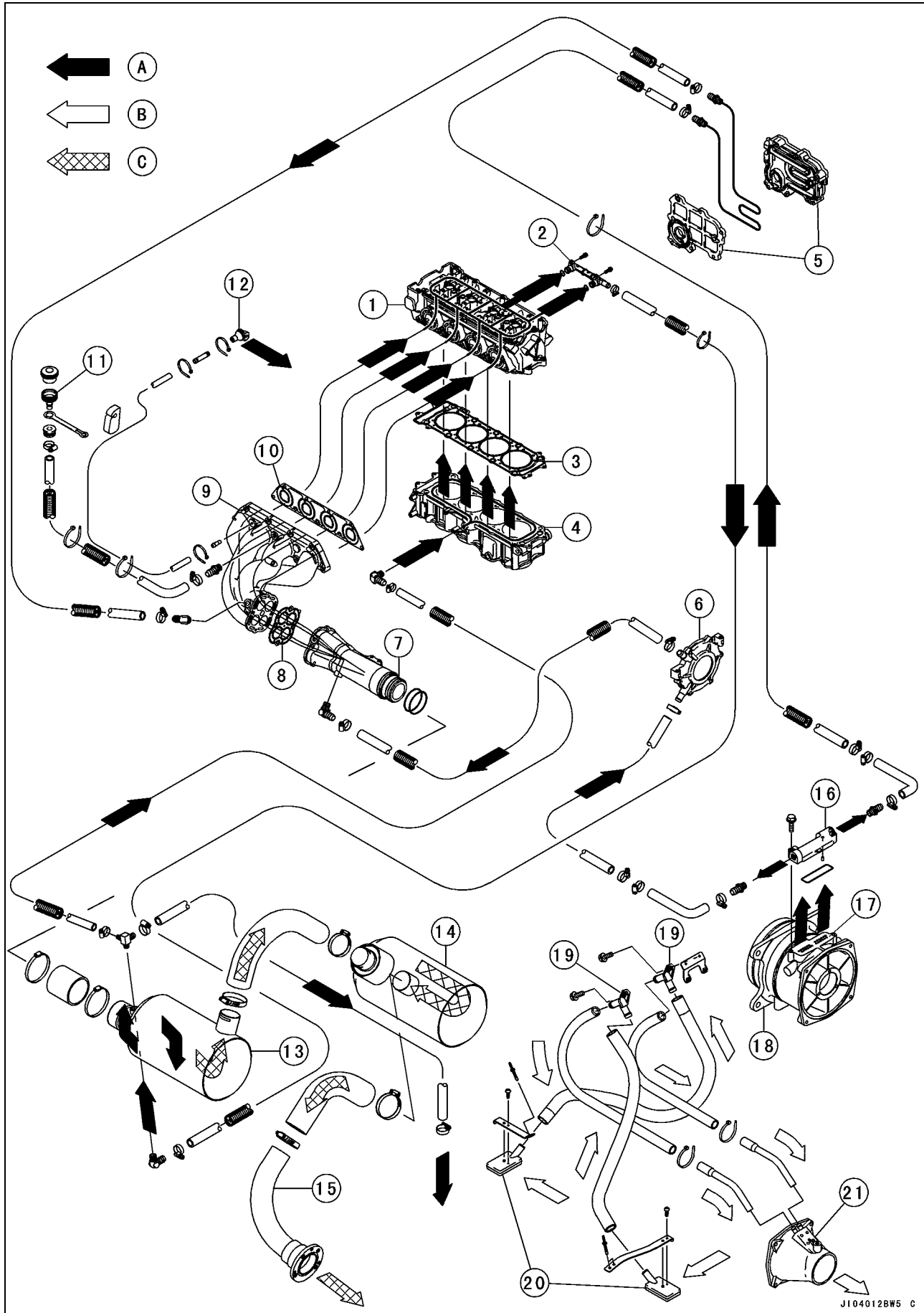
- Refer to Cooling System Flushing in the Periodic Maintenance chapter.

Bilge System Flushing

- Refer to Bilge System Flushing in the Periodic Maintenance chapter.

9-8 COOLING AND BILGE SYSTEMS

Cooling and Bilge System Flow Diagram



Cooling and Bilge System Flow Diagram

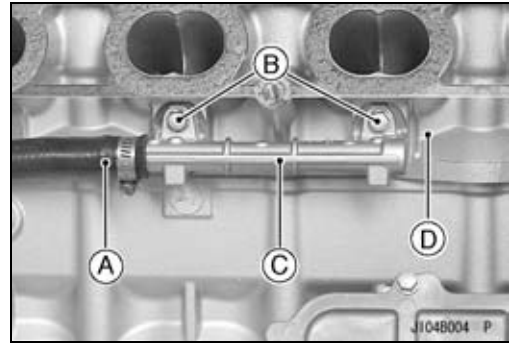
1. Cylinder Head
 2. Water Pipe
 3. Cylinder Head Gasket
 4. Cylinder
 5. Oil Cooler
 6. Output Cover
 7. Exhaust Pipe
 8. Exhaust Pipe Gasket
 9. Exhaust Manifold
 10. Exhaust Manifold Gasket
 11. Flushing Fitting
 12. Bypass Outlet
 13. Left Water Box Muffler
 14. Right Water Box Muffler
 15. Tail Pipe
 16. Cooling Water Filter Cover
 17. Cooling Water Filter
 18. Pump
 19. Bilge Breather
 20. Bilge Filter
 21. Pump Outlet
- A. Direction of Cooling System Flow
B. Direction of Bilge System Flow
C. Direction of Combined Exhaust Gas and Cooling Water Flow

9-10 COOLING AND BILGE SYSTEMS

Water Pipe

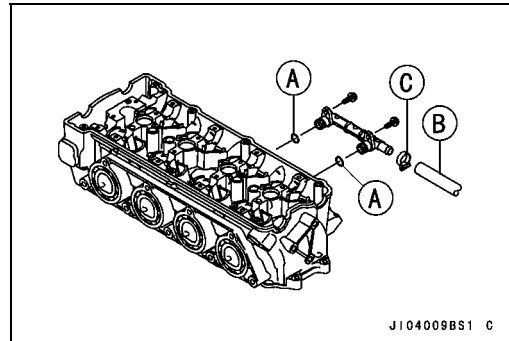
Water Pipe Removal

- Remove the inlet manifold (see Fuel System).
- Disconnect the cooling hose [A] onto the water pipe fitting.
- Unscrew the mounting bolts [B] and remove the water pipe [C] from the cylinder head [D].



Water Pipe Installation

- Apply grease to the O-rings [A] and install the water pipe with the mounting bolts.
- Install cooling hose [B] (cylinder head ~ water box muffler) to the water pipe fitting and secure the hose clamp [C].



After Submerging

CAUTION
<p>Do not operate the watercraft with water in the engine.</p> <p>Do not try to start the engine until it is completely empty of water; internal engine parts could be severely and immediately damaged. If water gets into the engine, follow this procedure immediately! If water is left in the engine more than a few hours, it will destroy the crankshaft bearings and damage other internal engine parts.</p>

If the watercraft becomes swamped, water may enter the engine through the throttle body. Water may also enter the fuel tank.

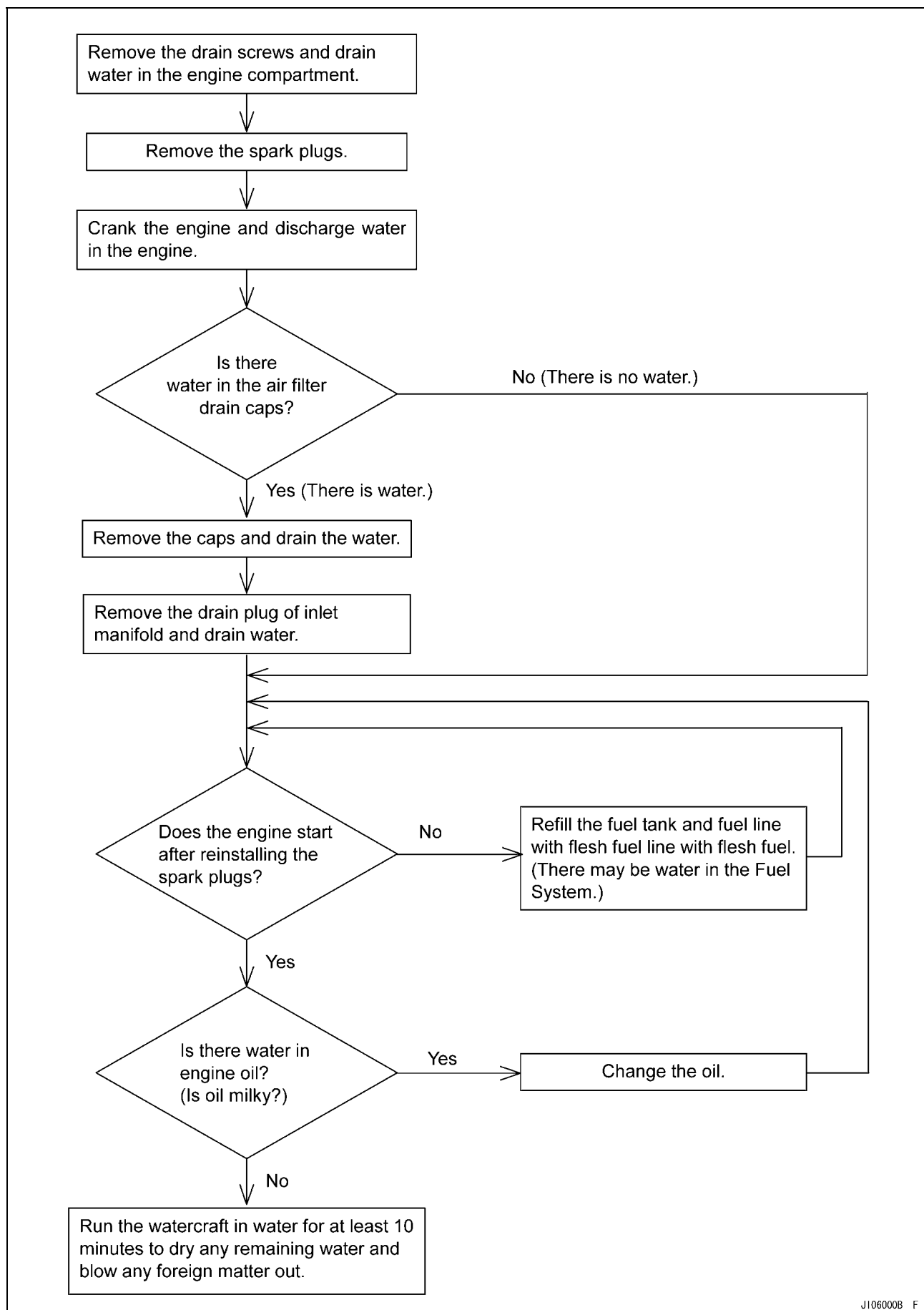
The following procedures explain the necessary steps you must provide.

Read the summary of the procedure first and then their detailed procedures carefully.

Summary Procedures after Submerging

9-12 COOLING AND BILGE SYSTEMS

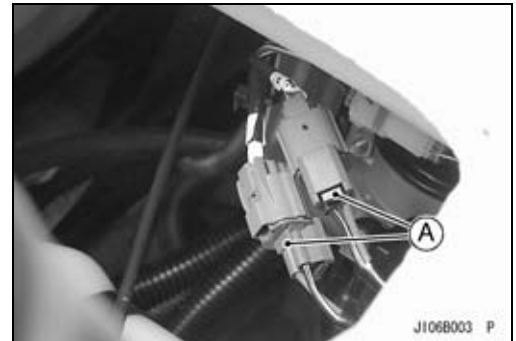
After Submerging



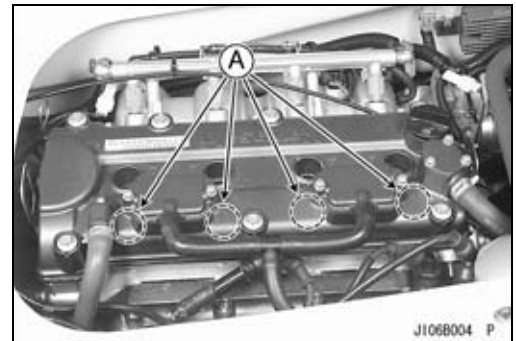
After Submerging

Detailed Procedures after Submerging

1. Remove the seat (see Hull/Engine Hood chapter).
2. Remove the drain screws in the stern to drain water out of the engine compartment.
3. Remove the front storage pocket (see Hull/Engine Hood chapter).
4. Disconnect both two connectors [A] on the primary ignition leads located near the ignition coil.



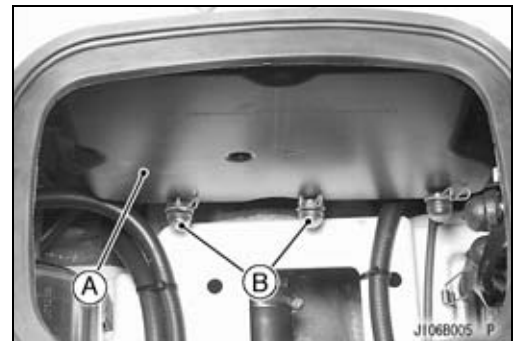
5. Pull and remove all the spark plug caps.
6. Remove all spark plugs. (see Spark Plug Cleaning and Inspection in Periodic Maintenance chapter)
7. Turn the ignition switch on, push the lanyard key under the stop button, and push the start button.
8. If there is any water in the engine, it will be pumped out of the spark plug holes [A]. Do not operate the starter for longer than 5 seconds. Wait 15 seconds before using it again. Be sure that all the water is out of the engine.



⚠ WARNING

Do not lean over the engine when performing this procedure. A water and gasoline mixture will be forcibly ejected from the spark plug holes and could get into your eyes. If you do get some in your eyes, wash your eyes immediately with liberal amounts of clean, fresh water. Consult a physician as soon as possible.

9. Remove the rear storage pocket, and check the air filter [A] for water inside with its drain caps [B].
10. If you see water in the caps, remove both caps and discharge the water. Be sure to have a rag or cloth underneath for possible oily water. And proceed to the next procedure (No.11).



NOTE

If you see water in the caps, there is a great possibility that water has entered the inlet manifold. If there is no water in the caps, then proceed to No.12.

11. Remove the drain plug [A] of the inlet manifold [B] and discharge water, if any, into a rag or cloth. (If you do not see water in the caps for the air filter mentioned above, omit this procedure and proceed to the next procedure, No.12).



12. Spray the spark plugs clean and install them with their plug caps.

9-14 COOLING AND BILGE SYSTEMS

After Submerging

13. Reconnect the primary ignition coil lead connectors, noting the #1,#4 [A] and the #2, #3 [B] coil connectors. The #1, #4 coil connector has a red/yellow and a green/blue leads from the main harness. The #2, #3 coil connector has a red/yellow and green/black leads from the main harness.

NOTE

○The service codes (COIL1 and COIL2) caused by this procedure are stored in the ECU. If necessary, these service codes can be erased by using the Kawasaki Diagnostic System (KDS).

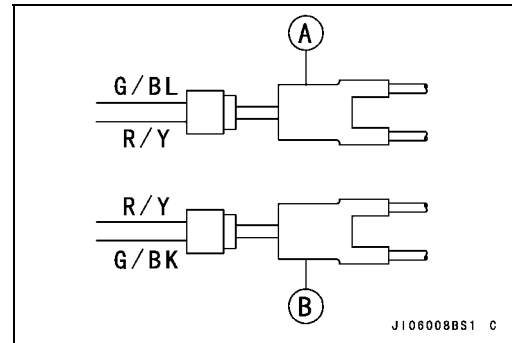
14. Start the engine by pressing the start button and run less than 15 seconds.

CAUTION

Do not run the engine with the watercraft out of the water for more than 15 seconds at a time. Overheating will cause severe engine and exhaust system damage.

Never operate the engine at maximum speed out of the water. Severe engine damage may occur.

15. Remove the dipstick [A] and check for the water presence in the engine oil. (If there is water in it, oil looks milky.)
16. If the oil looks milky, then change the oil and repeat procedures 14 and 15 until the oil does not turn milky any more.
17. If the engine does not start, there may be water in the fuel system.



After Submerging

18. If the fuel tank has water in it, it must be emptied by pump or siphon. Refill the tank with fresh fuel. Do not dump contaminated fuel in places not designated for that purpose.

WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

WARNING

Gasoline is toxic substance. Dispose of gasoline properly. Contact your local authorities for approved disposal methods.

19. Continued trouble may require cleaning of the fuel line to drain water.
20. Try to start the engine (procedure No.14) and proceed to the procedures No.15 and 16.
21. Reinstall the seat and secure it.
22. Reinstall the drain screws in the stern.
23. Finally, run the watercraft IN WATER for at least 10 minutes to dry any remaining water and blow any foreign matter (like salt) out through the exhaust.

Drive System

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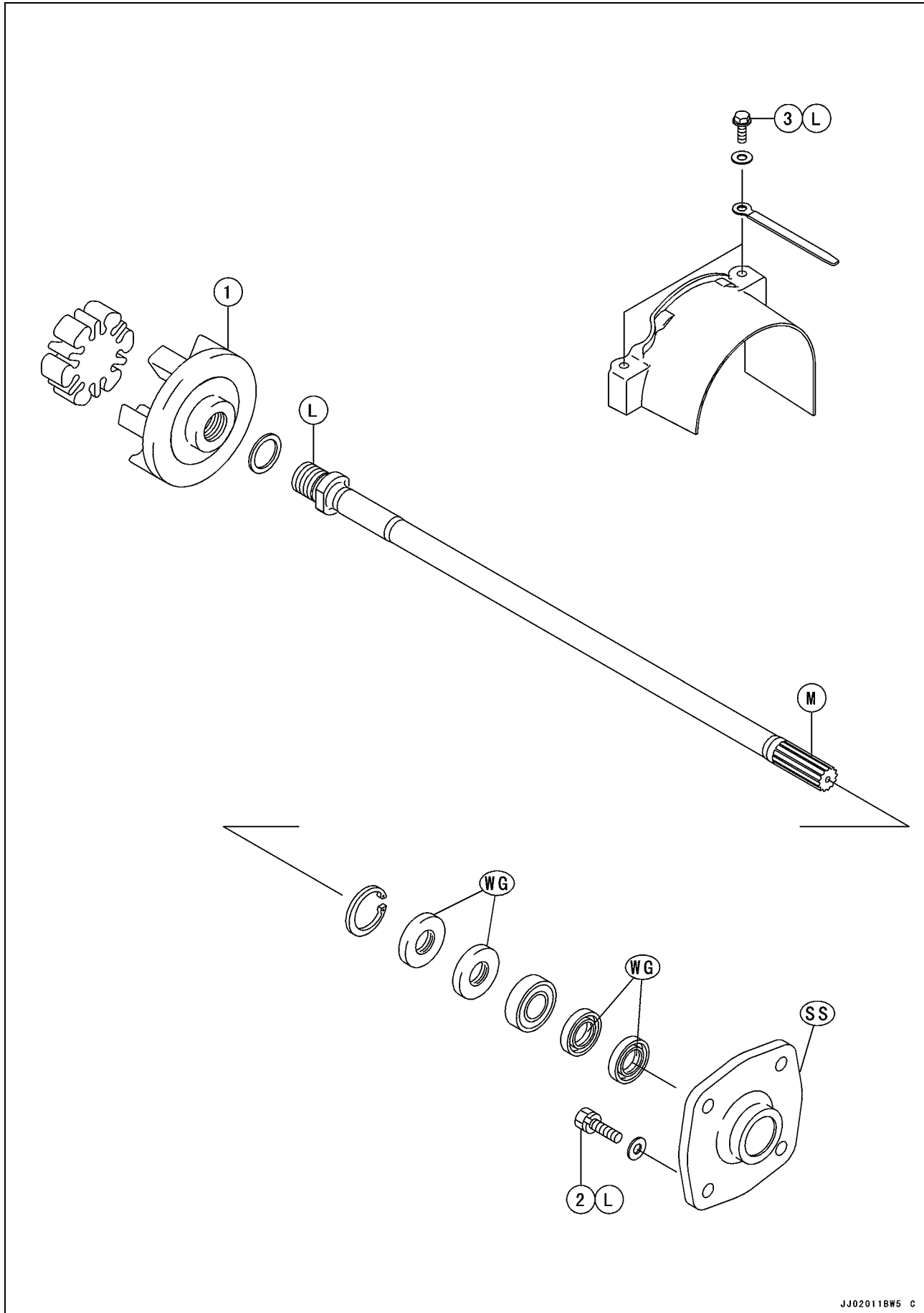
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 Drive Shaft Runout..... 10-8

10-2 DRIVE SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Coupling	39	4.0	29	
2	Drive Shaft Holder Mounting Bolts	22	2.2	16	L
3	Coupling Cover Bolts	8.8	0.90	78 in·lb	L

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

SS: Apply silicone sealant.

WG: Apply water resistance grease.

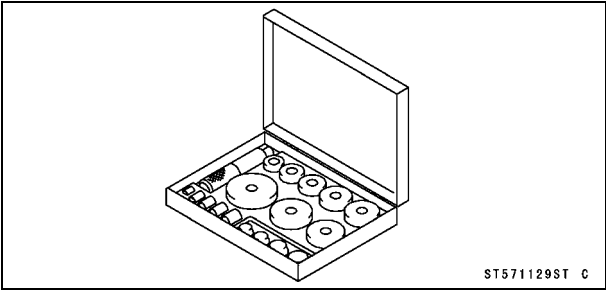
10-4 DRIVE SYSTEM

Specification

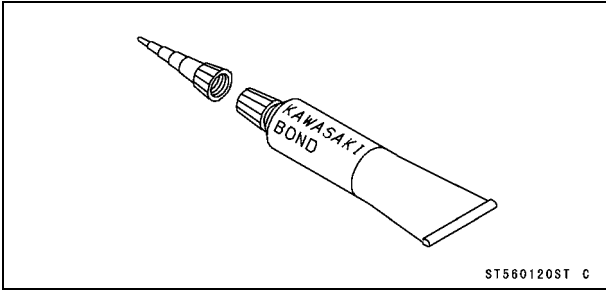
Item	Standard	Service Limit
Drive Shaft Runout (see P10-8)	[A] Less than 0.1 mm (0.0039 in.) [B] Less than 0.2 mm (0.0079 in.)	0.2 mm (0.0079 in.) 0.6 mm (0.0236 in.)

Special Tools and Sealant

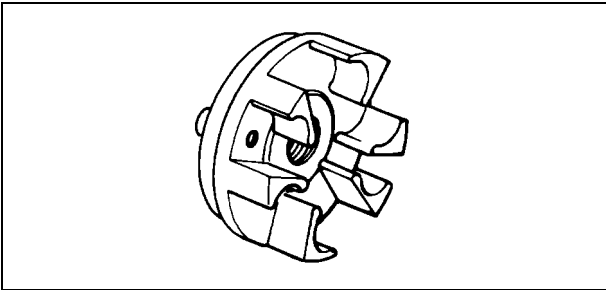
Bearing Driver Set:
57001-1129



Kawasaki Bond (Silicone Sealant):
56019-120



Coupling Holder #2:
57001-1423



10-6 DRIVE SYSTEM

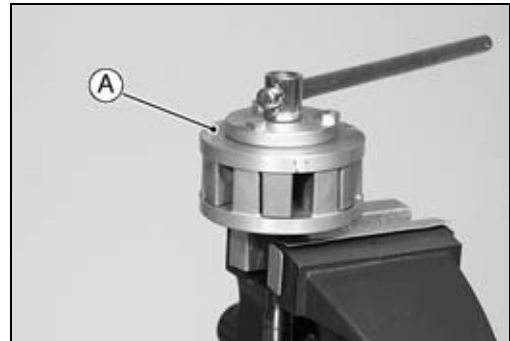
Drive Shaft/Drive Shaft Holder

Drive Shaft Removal/Installation

- Remove the engine (see Engine Removal/Installation chapter).
- Pull the drive shaft [A] out of the hull.



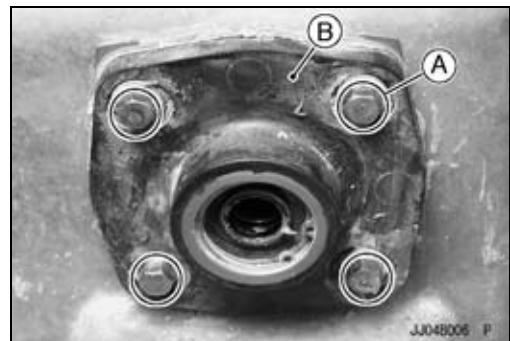
- Hold the drive shaft in a vice, and unscrew the coupling.
Special Tool - Coupling Holder: 57001-1423 [A]



- When installing the drive shaft, be careful of the following items.
- Apply a non-permanent locking agent to the coupling threads and tighten it.
Torque - Coupling: 39 N·m (4.0 kgf·m, 29 ft·lb)
- Apply grease to the grease seal lips and the drive shaft spline.

Drive Shaft Holder Removal/Disassembly

- Remove the drive shaft.
- Unscrew the mounting bolts [A] and remove the drive shaft holder [B] from the bulkhead.

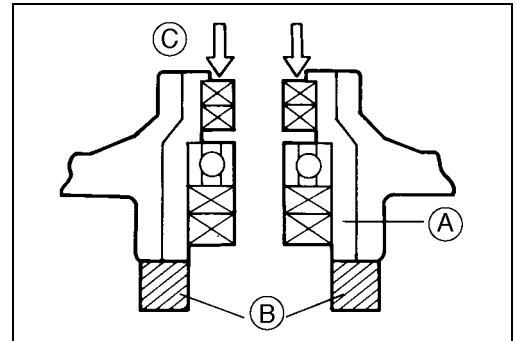


- Disassemble the drive shaft holder.
- Remove the circlip [A].



Drive Shaft/Drive Shaft Holder

- Press the small grease seal, and the large grease seals, bearing, and small grease seals come out of the holder.
 - [A] Sleeve
 - [B] Blocks
 - [C] Press

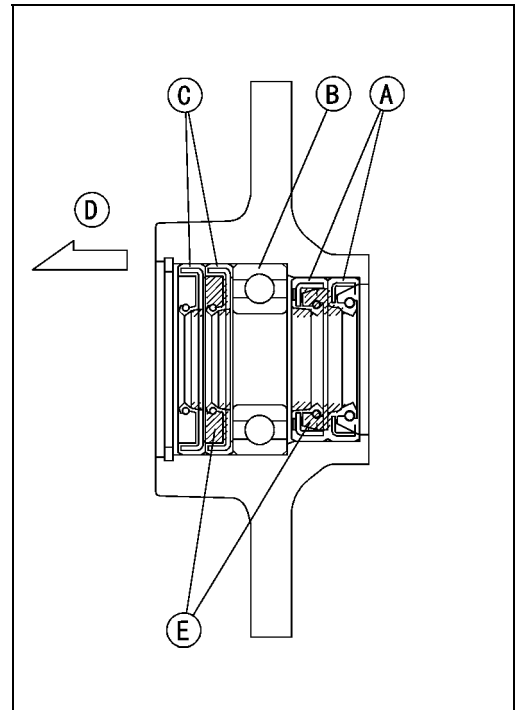


Drive Shaft Holder Assembly/Installation

- Replace the grease seals with new ones.
- Press the bearing and grease seals into the drive shaft holder, noting the following.
- Install the parts in this order.
 - Two Small Grease Seals [A]
 - One Bearing [B]
 - Two Large Grease Seals [C]
 - Front [D]

Special Tool - Bearing Driver Set: 57001-1129

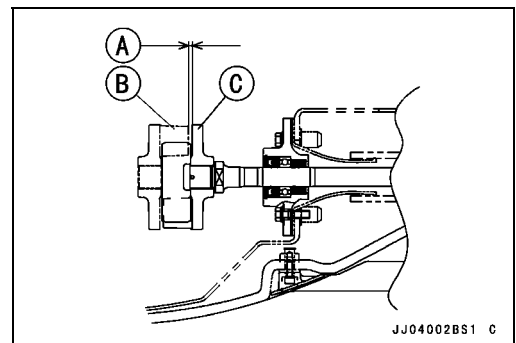
- Install the seals so that the sides with the spring face outward.
- Fill the gaps between the seals with water resistance grease [E].
- Install the circlip.
- Apply water resistance grease to the bearing inner surface and grease seal lips.



- Install the drive shaft holder on the bulkhead so that the circlip side face toward the front.
- Apply a non-permanent locking agent to the drive shaft holder mounting bolts, tighten them loosely.
- Install the drive shaft.
- After installing the engine, tighten the drive shaft holder mounting bolts to the specified torque to give proper coupling alignment.

Torque - Drive Shaft Holder Mounting Bolts: 22 N·m (2.2 kgf·m, 16 ft·lb)

- Make sure the clearance [A] between the engine coupling [B] and the drive shaft coupling [C] is 3 ~ 5 mm (0.12 ~ 0.20 in.).



JJ04002BS1 C

10-8 DRIVE SYSTEM

Drive Shaft/Drive Shaft Holder

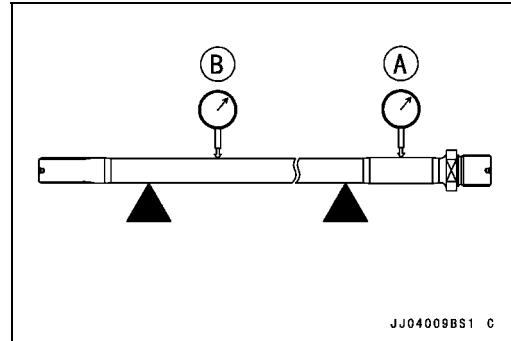
Drive Shaft Runout

- Measure drive shaft runout by supporting the shaft on V blocks and setting a dial gauge against the shaft at each point shown.
- Turn the drive shaft slowly. The difference between the highest and lowest dial gauge reading is the runout.
- ★ If any measurement exceeds the service limit, replace the shaft.

Drive Shaft Runout

Standard: **Less than 0.1 mm (0.0039 in.) [A]**
 Less than 0.2 mm (0.0079 in.) [B]

Service Limit: **0.2 mm (0.0079 in.) [A]**
 0.6 mm (0.0236 in.) [B]



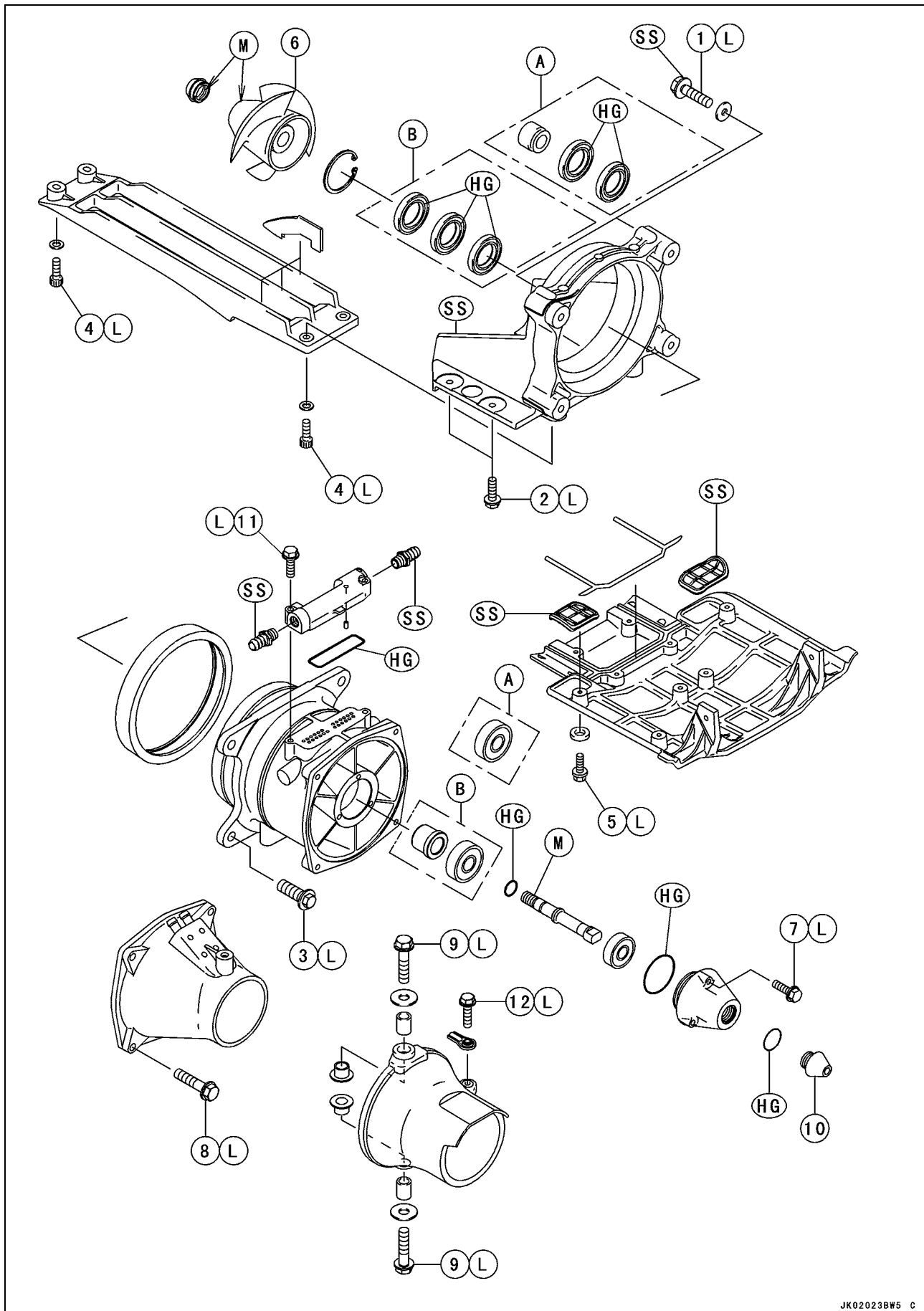
Pump and Impeller

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11-2 PUMP AND IMPELLER

Exploded View



PUMP AND IMPELLER 11-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Pump Bracket Mounting Bolts (2)	19	1.9	14	L, SS
2	Pump Bracket Mounting Bolts (4)	9.8	1.0	87 in·lb	L
3	Pump Mounting Bolts	36	3.7	27	L
4	Grate Mounting Bolts	9.8	1.0	87 in·lb	L
5	Pump Cover Mounting Bolts	7.9	0.80	69 in·lb	L
6	Impeller	98	10	72	
7	Pump Cap Bolts	9.8	1.0	87 in·lb	L
8	Pump Outlet Mounting Bolts	19	1.9	14	L
9	Steering Nozzle Pivot Bolts	19	1.9	14	L
10	Pump Cap Plug	3.9	0.40	35 in·lb	
11	Filter Cover Mounting Bolts	9.8	1.0	87 in·lb	L
12	Steering Cable Joint Bolt	9.8	1.0	87 in·lb	L

A: JT1500-A1 Model

B: JT1500-A2 Model ~

HG: Apply high grade water resistance grease (Chevron: Black Pearl Grease EP NLGI 2 or equivalent).

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

SS: Apply silicone sealant.

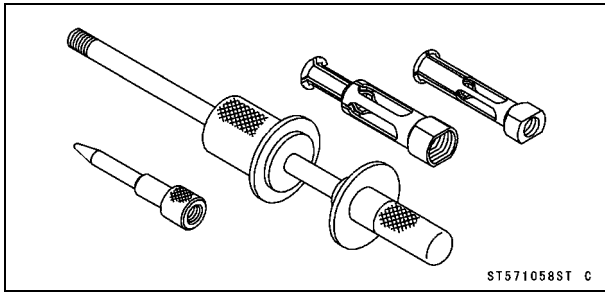
11-4 PUMP AND IMPELLER

Specifications

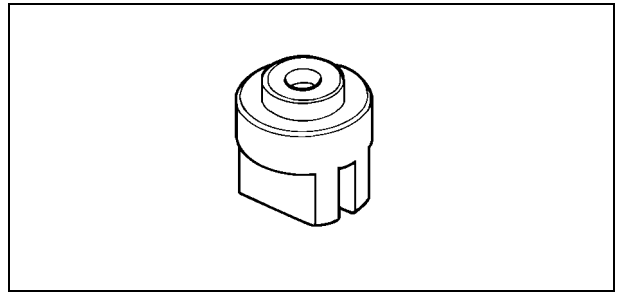
Item	Standard	Service Limit
Jet Pump		
Impeller Outside Diameter	147.5 ~ 147.7 mm (5.8071 ~ 5.8149 in.)	146.5 mm (5.7677 in.)
Pump Case Inside Diameter	148.0 ~ 148.1 mm (5.8268 ~ 5.8307 in.)	149.1 mm (5.8701 in.)
Impeller Clearance	0.15 ~ 0.3 mm (0.0059 ~ 0.0118 in.)	0.6 mm (0.0236 in.)

Special Tools and Sealant

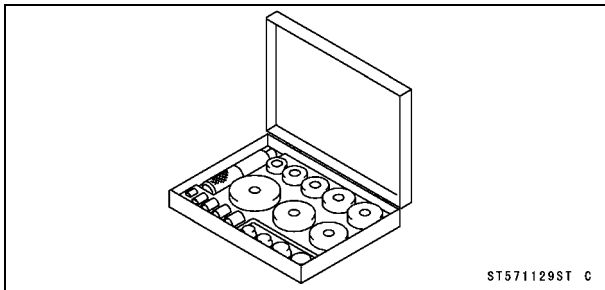
**Oil Seal & Bearing Remover:
57001-1058**



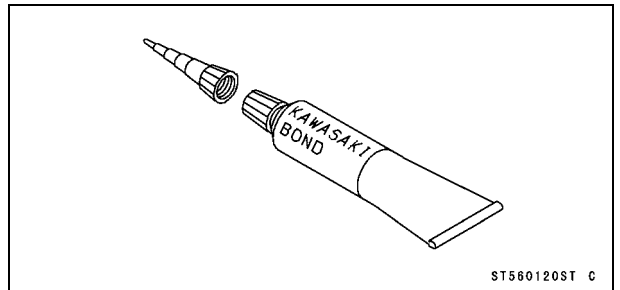
**Impeller Holder:
57001-1393**



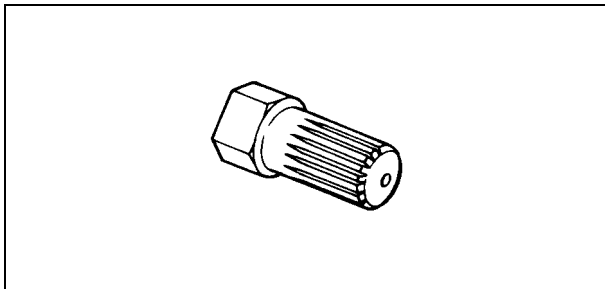
**Bearing Driver Set:
57001-1129**



**Kawasaki Bond (Silicone Sealant):
56019-120**



**Impeller Wrench:
57001-1228**

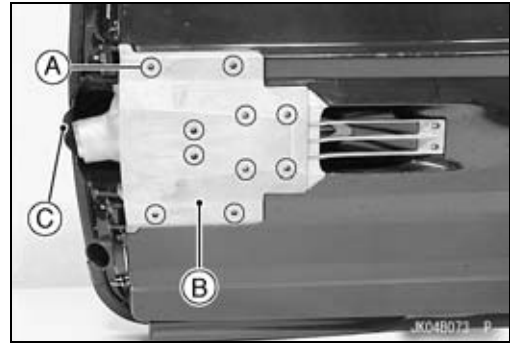


11-6 PUMP AND IMPELLER

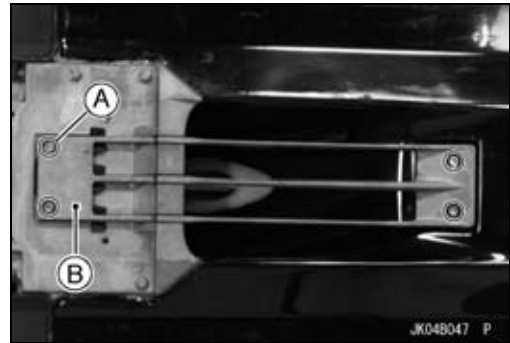
Pump and Impeller

Pump Removal

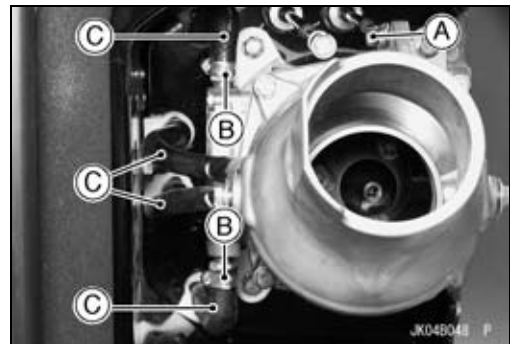
- Turn the craft on its left side.
- Disconnect the reverse cable ball joint at the rear end.
- Unscrew the pump cover mounting bolts [A], and remove the pump cover [B] with the reverse bracket [C].



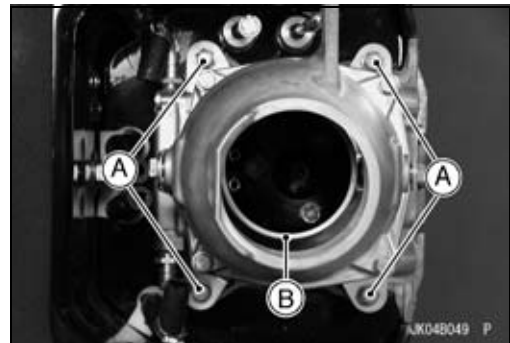
- Unscrew the grate mounting bolts [A] and remove the grate [B].



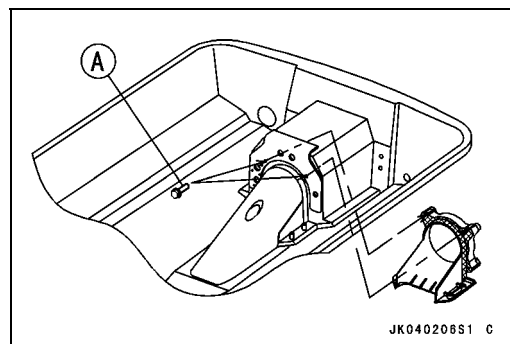
- Remove the joint bolts [A] and take off the steering cable joint.
- Loosen the clamps [B] on the inlet cooling hose, and pull off the hoses [C].



- Unscrew the pump mounting bolts [A].
- Slide the pump [B] to the rear to disengage the drive shaft, and remove it from the hull.

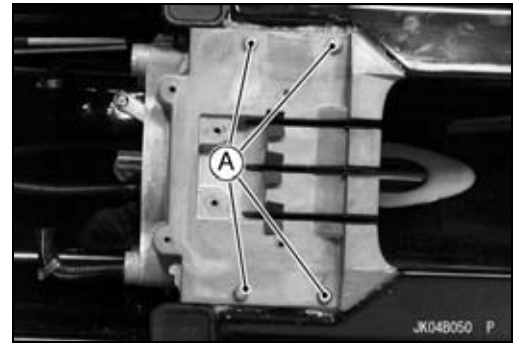


- To remove the pump bracket, perform the following procedures.
 - Take out the pump bracket mounting bolts [A] and washer in the hull.

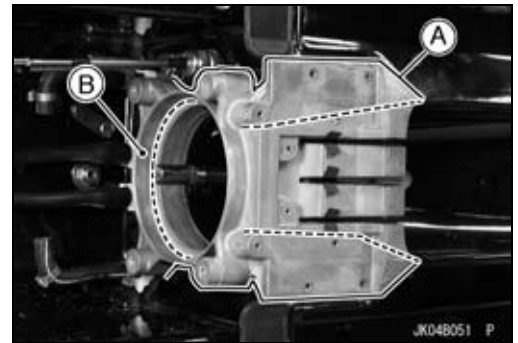


Pump and Impeller

○Take out the pump bracket mounting bolts [A].



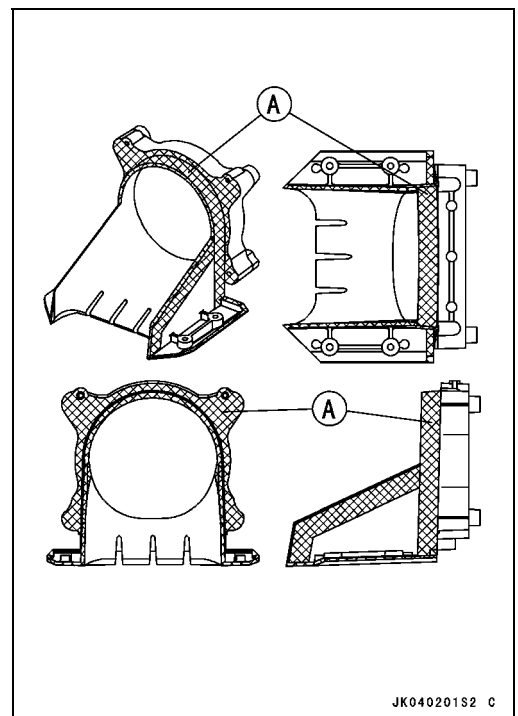
○Cut the sealant at the indicated area [A] in the figure and remove the pump bracket [B].



Pump Installation

- Strip off all the old sealant around the pump intake.
- Liberally coat the outside edge of the pump bracket with silicon sealant [A] to form a seal between the bracket and the hull.

Sealant - Kawasaki Bond (Silicone Sealant): 56019-120



- Install the pump bracket [A] to the hull.
- Apply a non-permanent locking agent to the following bolts and torque them.

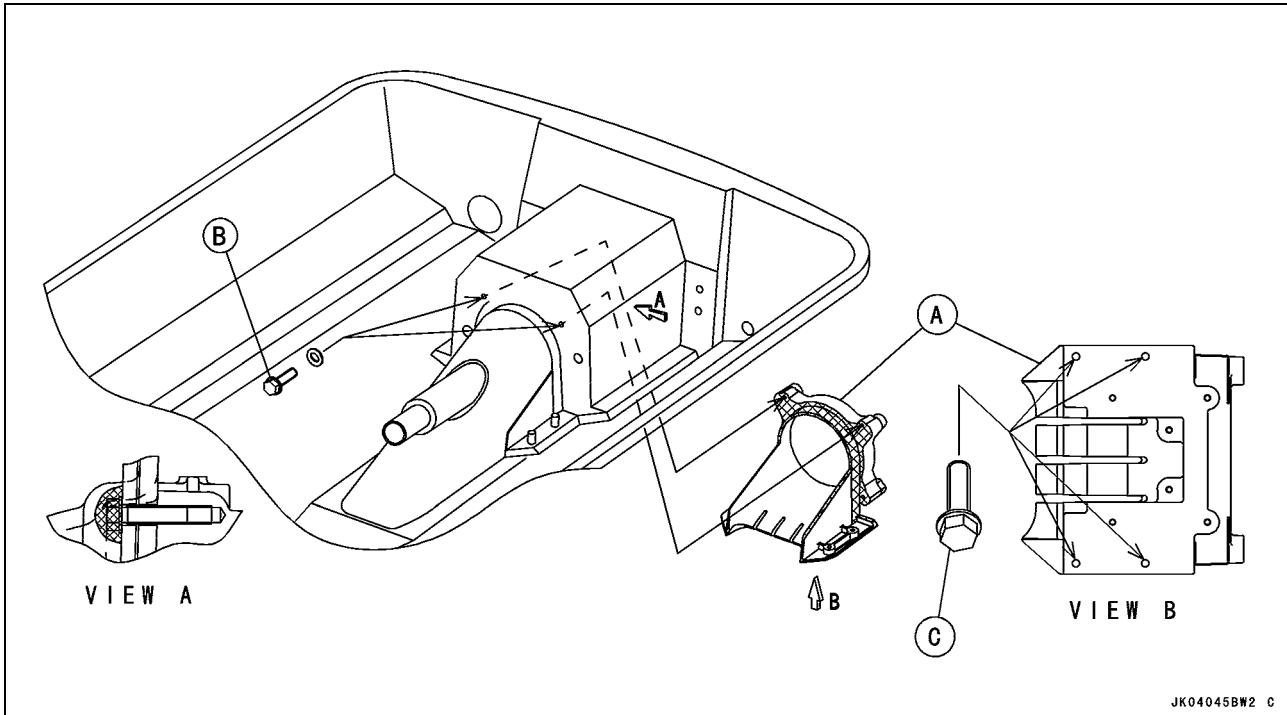
Torque - Pump Bracket Mounting Bolts (2) [B]: 19 N·m (1.9 kgf·m, 14 ft·lb)

Pump Bracket Mounting Bolts (4) [C]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

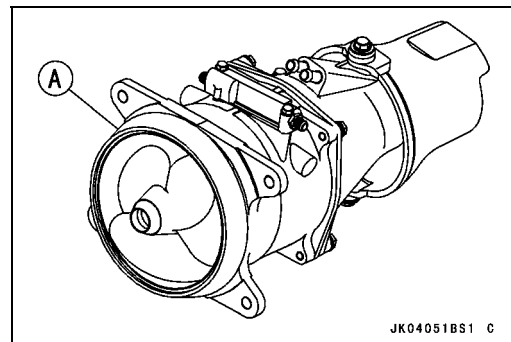
○As for the pump bracket mounting bolts (2) in the hull, the bolt heads should be wrapped in silicone sealant.

11-8 PUMP AND IMPELLER

Pump and Impeller



- Be sure trim seal [A] is in place.

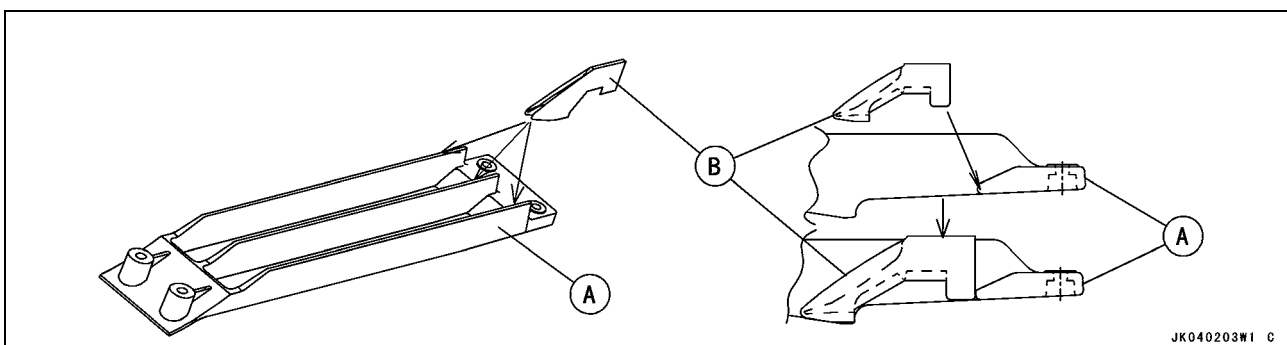


- Grease the splines on the drive shaft with water resistant grease.
- Install the pump.
- Apply a non-permanent locking agent to the pump mounting bolts and torque them.

Torque - Pump Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)

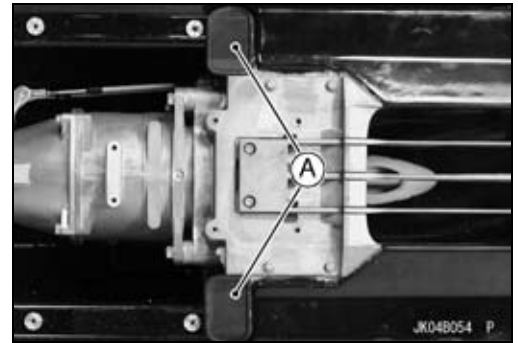
- Install the grate [A].
- Be sure the trim seals [B] are in the position.
- Apply a non-permanent locking agent to the grate mounting bolts and torque them.

Torque - Grate Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

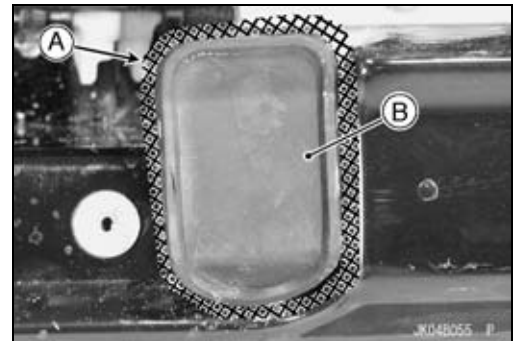


Pump and Impeller

- Be sure the seals [A] on the hull are in the position.

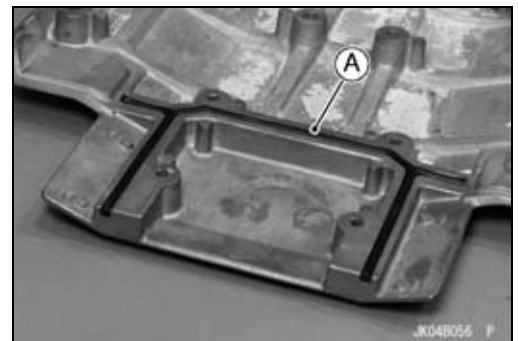


- Coat the outside edge [A] of the seal [B] with silicone sealant to form a seal between the hull and seal.



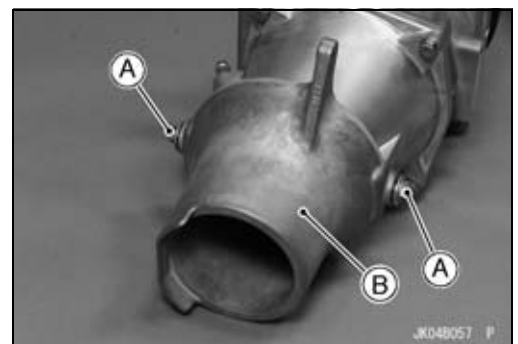
- Install the pump cover.
- Be sure the seal [A] is in the position.
- Apply a non-permanent locking agent to the pump cover mounting bolts and torque them.

Torque - Pump Cover Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

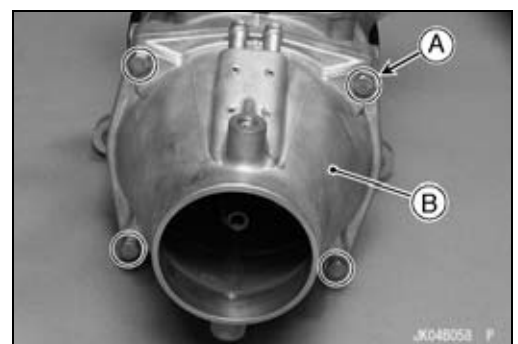


Pump Disassembly

- Unscrew the steering nozzle pivot bolts [A], and remove the steering nozzle [B].



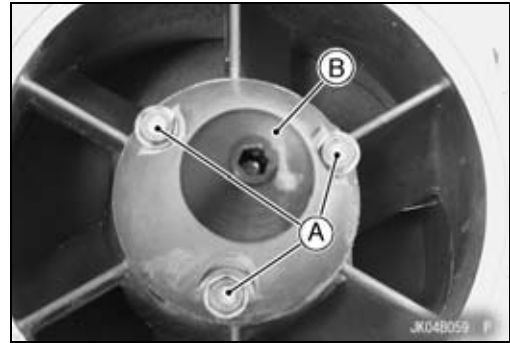
- Unscrew the pump outlet mounting bolts [A], and remove the pump outlet [B].



11-10 PUMP AND IMPELLER

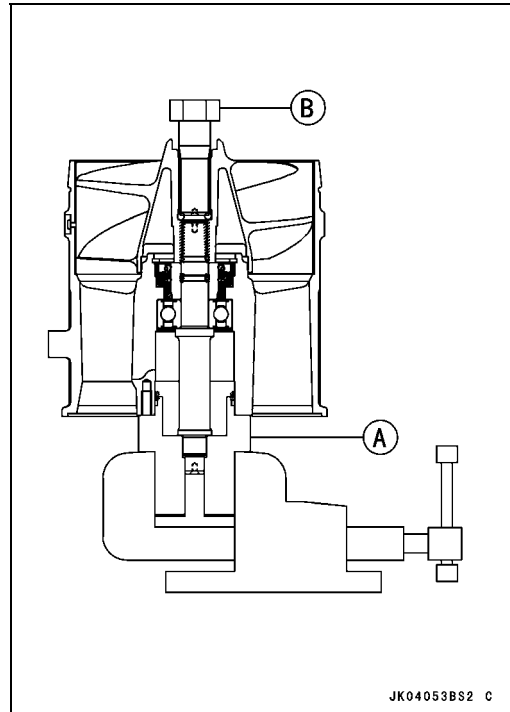
Pump and Impeller

- Unscrew the pump cap bolts [A], and remove the pump cap [B].



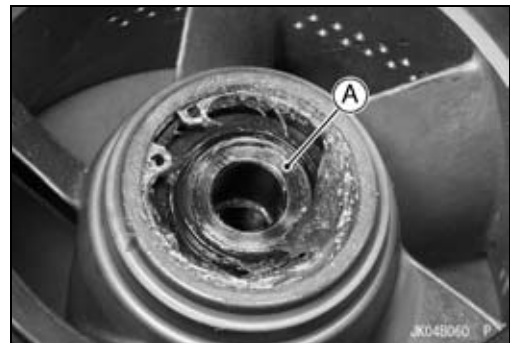
- Pull out the impeller seal on the impeller.
- Hold the shaft in the impeller holder, taking care not to damage it. Remove the impeller from the pump shaft and then pull out the pump shaft.

**Special Tools - Impeller Holder: 57001-1393 [A]
Impeller Wrench: 57001-1228 [B]**



JT1500-A1;

- Pull out the bushing [A].



- Remove the circlip.
- Remove the grease seals.

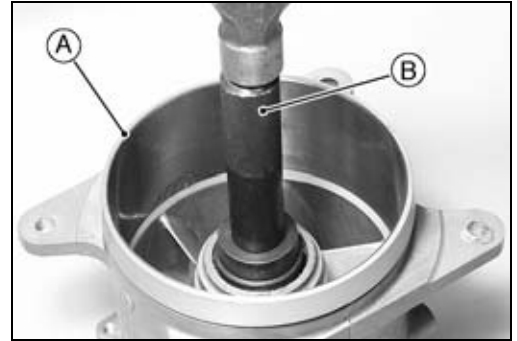
Special Tool - Oil Seal & Bearing Remover: 57001-1058 [A]



Pump and Impeller

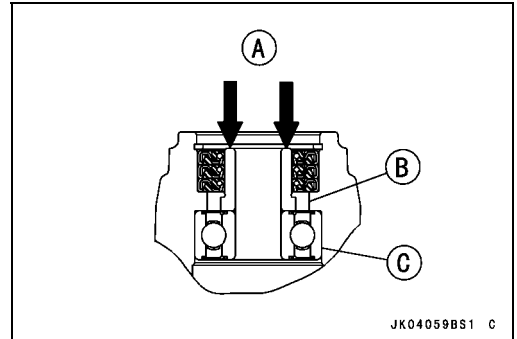
- Remove the bearing by tapping evenly around the bearing inner race from the front end of the pump case [A].

Special Tool - Bearing Driver Set: 57001-1129 [B]



JT1500-A2 ~;

- Press [A] the bussing [B] and the ball bearing [C]. They come out of the pump case.



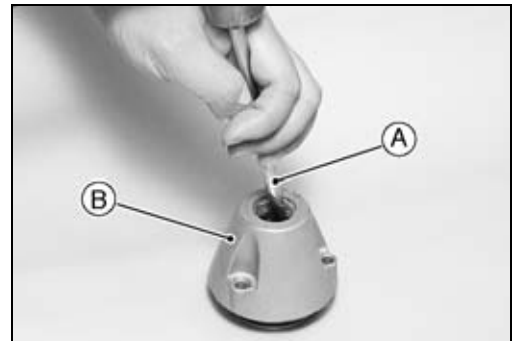
- Remove the circlip.
- Remove the grease seals.

Special Tool - Oil Seal & Bearing Remover: 57001-1058 [A]



JT1500-A1,A2 ~;

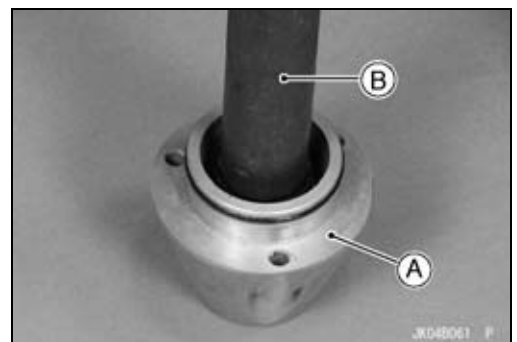
- Insert a metal rod [A] into the pump cap [B] from the rear end, remove the bearing by tapping evenly around the bearing inner race from the rear end of the pump cap.



Pump Assembly

- Before installing the cap bearing, blow any dirt or foreign particles out of the pump cap [A] with compressed air.
- Install new bearing into the cap as far as it will go.

Special Tool - Bearing Driver Set: 57001-1129 [B]



11-12 PUMP AND IMPELLER

Pump and Impeller

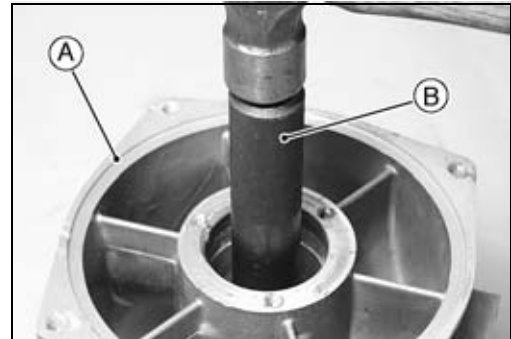
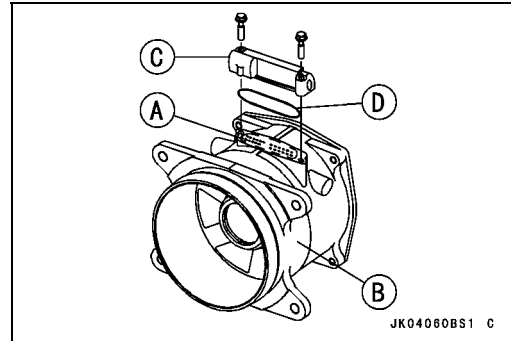
- Before installing the pump bearing, blow any dirt or foreign particles out of the pump case with compressed air.
- Before installing the pump bearing, remove the filter cover [C], and check the filter inside or outside [A] on the pump case [B] if the foreign particles do not cling to the filter.
- Apply high grade water resistant grease to the O-ring [D].
- Apply a non-permanent locking agent to the filter cover mounting bolts and torque them.

Torque - Filter Cover Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

JT1500-A1;

- Install a new bearing into the pump case [A] as far as it will go.

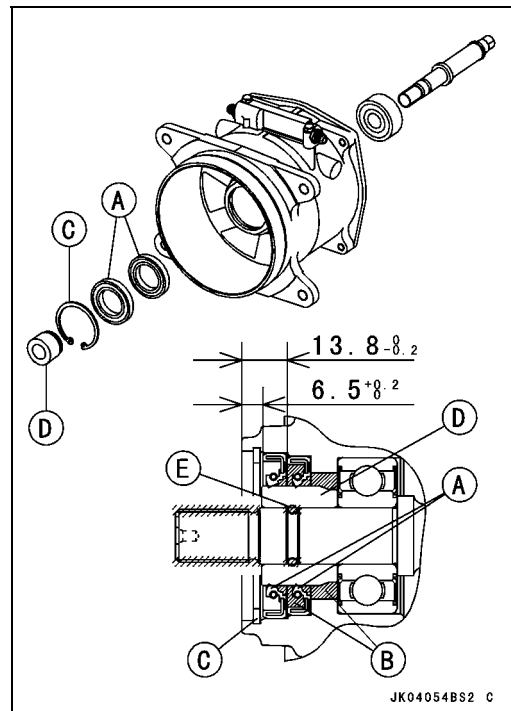
Special Tool - Bearing Driver Set: 57001-1129 [B]



- Replace the grease seals with new ones, if necessary, and install them.

Special Tool - Bearing Driver Set: 57001-1129

- Press each seal [A] into the pump case so that the side with the spring faces outward. Fill [B] the gap between the seals, and between the seal and the bearing with high grade water resistance grease.
- Install the circlip [C].
- Push the bushing [D] into the pump case.
- Visually inspect into the pump shaft O-rings [E], and replace them if necessary .
- Apply molybdenum disulfide grease to the pump shaft and insert it from rear of the pump case.



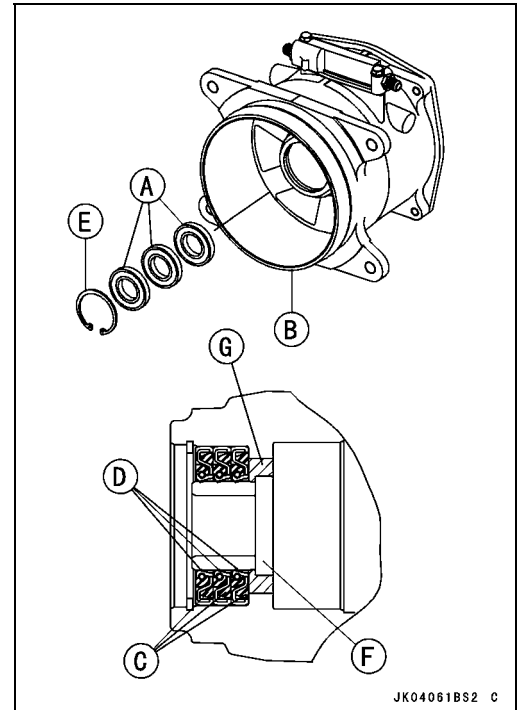
Pump and Impeller

JT1500-A2 ~;

- Replace the grease seals with new ones, if necessary, and install them.

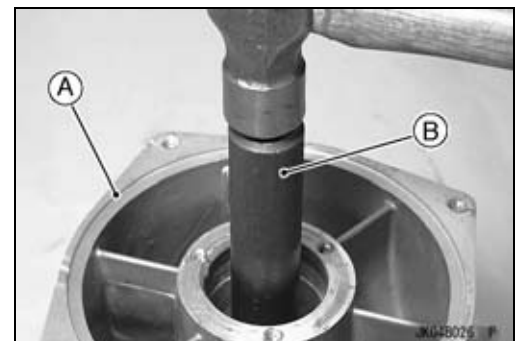
Special Tool - Bearing Driver Set: 57001-1129

- Press each seal [A] into the pump case [B] so that the side with the spring faces outward.
- Fill the gap between the grease seals [C] with high grade water resistance grease and apply it each grease seal lip [D].
- Install the circlip [E].
- Install the bushing [F] into the pump case.
- Fill with high grade water resistance grease [G].

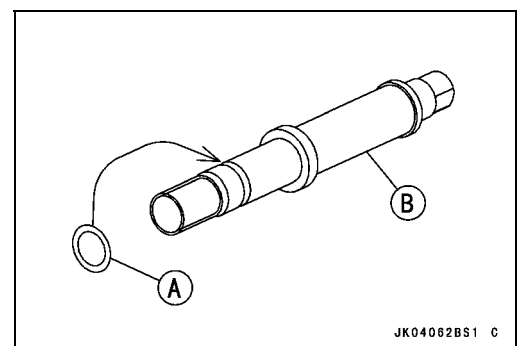


- Install a new bearing into the pump case [A] as far as it will go.

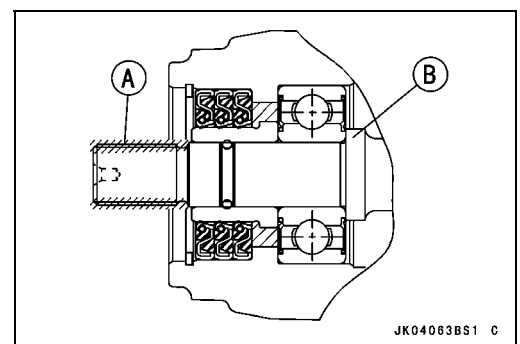
Special Tool - Bearing Driver Set: 57001-1129 [B]



- Visually inspect the pump shaft O-rings [A], and replace if necessary.
- Install the O-ring over the pump shaft [B].
- Grease the O-ring with high grade water resistance grease.



- Apply molybdenum disulfide grease [A] to the thread of the pump shaft
- Push the pump shaft [B] into the pump case.



11-14 PUMP AND IMPELLER

Pump and Impeller

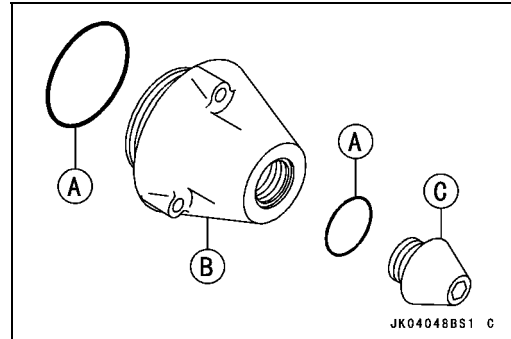
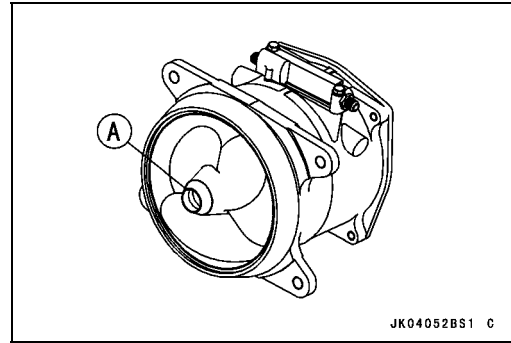
JT1500-A1, A2 ~;

- Screw on the impeller and torque.

Special Tools - Impeller Holder: 57001-1393
Impeller Wrench: 57001-1228

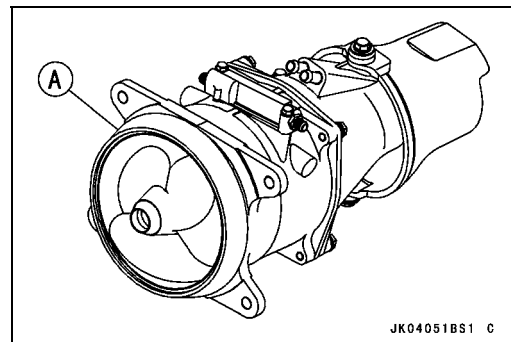
Torque - Impeller: 98 N·m (10 kgf·m, 72 ft·lb)

- Visually inspect impeller seal [A], and replace it if necessary.
- Install the seal on the impeller.
- Be sure the O-rings [A] are in place on the pump cap [B] and plug [C].
- Apply high grade water resistance grease to the O-rings.



- Install the following.
 - Pump Cap
 - Pump Cap Plug
 - Pump Outlet
 - Steering Nozzle
- Apply a non-permanent locking agent to the thread of the following.
 - Pump Cap Bolts
 - Pump Outlet Mounting Bolts
 - Steering Nozzle Pivot Bolts
- Torque - Pump Cap Plug: 3.9 N·m (0.40 kgf·m, 35 in·lb)**
- Pump Cap Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
- Pump Outlet Mounting Bolts: 19 N·m (1.9 kgf·m, 14 ft·lb)**
- Steering Nozzle Pivot Bolts: 19 N·m (1.9 kgf·m, 14 ft·lb)**

- Be sure the pump seal [A] is in place on the pump case.



Impeller Inspection

- Refer to Impeller Inspection in the Periodic Maintenance chapter.

Pump and Impeller

Impeller Outside Diameter Measurement

- Measure the impeller outside diameter.
- ★ If the impeller is worn smaller than the service limit, replace it.

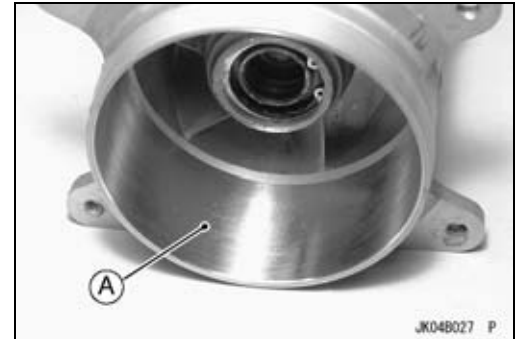
Impeller Outside Diameter

Standard: 147.5 ~ 147.7 mm (5.8071 ~ 5.8149 in.)

Service Limit: 146.5 mm (5.7677 in.)

Pump Inspection

- Examine the pump case [A].
- ★ If there are deep scratches inside the pump case, replace it.



- Measure the inside diameter of the pump case.
- ★ If the pump case is worn beyond the service limit, replace it.

Pump Case Inside Diameter

Standard: 148.0 ~ 148.1 mm (5.8268 ~ 5.8307 in.)

Service Limit: 149.1 mm (5.8701 in.)

Impeller Clearance

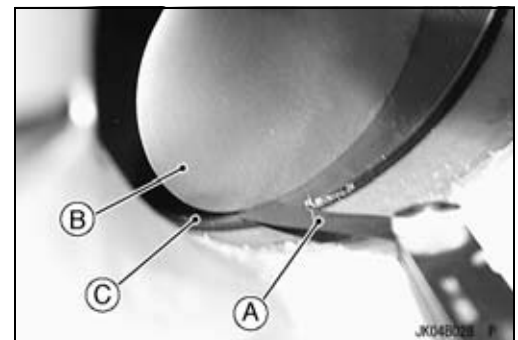
- Impeller clearance is critical to proper performance. If the pump case and impeller are not visibly damaged, poor performance may be caused by too much impeller clearance.
- To check impeller clearance, remove the grate and insert a feeler gauge [A] between the tip of the impeller blade [B] and the pump case [C].

Impeller Clearance

Standard: 0.15 ~ 0.3 mm (0.0059 ~ 0.0118 in.)

Service Limit: 0.6 mm (0.0236 in.)

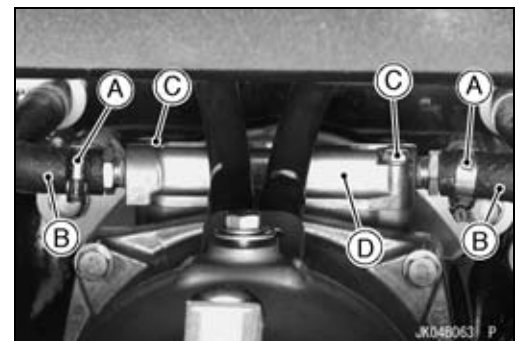
- ★ If impeller clearance is incorrect, determine if it is due to wear or damage (see Pump and Impeller Inspection).



Water Filter Cover Removal/Installation

- Loosen the clamps [A] and pull off the hoses [B].
- Remove the filter cover mounting bolts [C].
- Take out the filter cover [D].
- Replace the gasket with a new one.
- Installation is the reverse order of removal.
- Apply a non-permanent locking agent to the filter cover mounting bolts and torque them.

Torque - Filter Cover Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



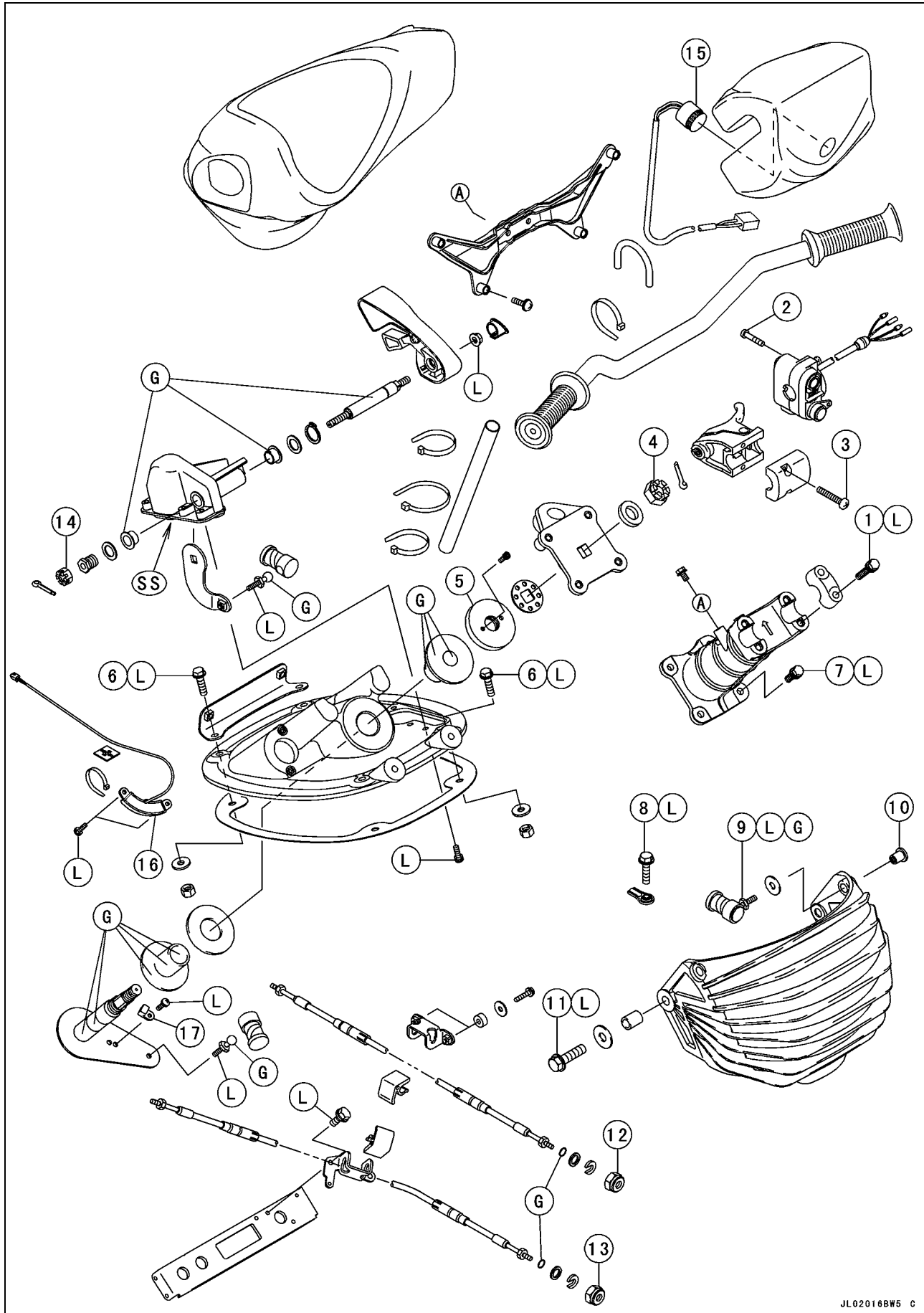
Steering

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12-2 STEERING

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Handlebar Clamp Bolts	16	1.6	12	L
2	Start/stop Switch Case Mounting Screws	3.9	0.40	35 in·lb	
3	Throttle Case Mounting Screws	3.9	0.40	35 in·lb	
4	Steering Shaft Locknut	49 ~ 59	5.0 ~ 6.0	36 ~ 43	
5	Steering Shaft Nut	–	–	–	Hand-Tight
6	Steering Holder Mounting Bolts	20	2.0	14.5	L
7	Steering Neck Mounting Bolts	16	1.6	12	L
8	Steering Cable Joint Bolt	9.8	1.0	87 in·lb	L
9	Ball Joint	9.8	1.0	87 in·lb	L
10	Shift Cable End Nut	9.8	1.0	87 in·lb	
11	Reverse Bucket Pivot Bolts	19	1.9	14	L
12	Shift Cable Nut	39	4.0	29	
13	Steering Cable Nut	39	4.0	29	
14	Shift Lever Locknut	20	2.0	14.5	

15. Buzzer

16. Steering Position Sensor

17. Magnet

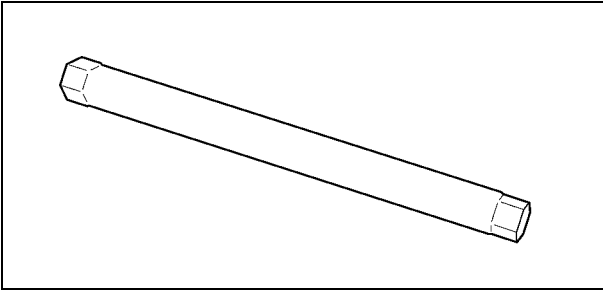
G: Apply grease.

L: Apply a non-permanent locking agent.

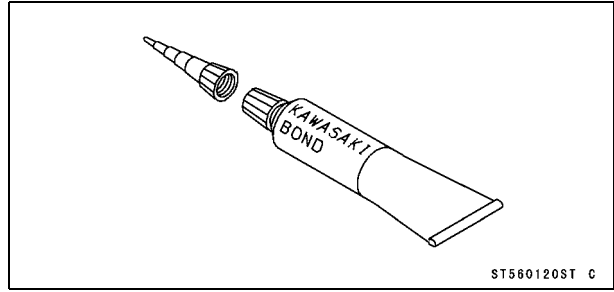
12-4 STEERING

Special Tool and Sealant

Box Wrench (27 mm):
57001-1451



Kawasaki Bond (Silicone Sealant):
56019-120



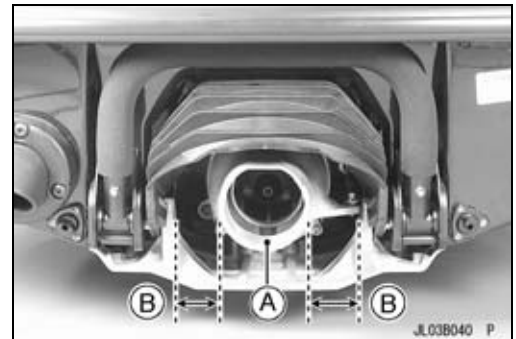
Steering Cable

Steering Cable Adjustment

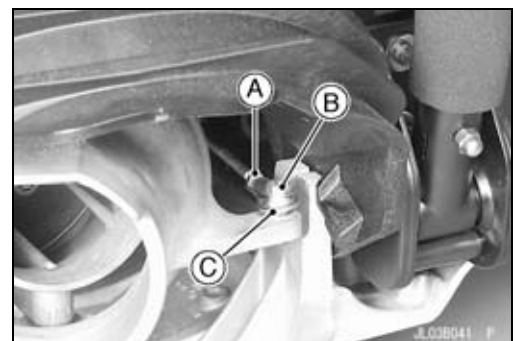
- Check the steering cable adjustment.
- Center the handlebar in the straight-ahead position.



- Check that the steering nozzle [A] is centered in the pump cavity.
- The same distance [B].



- If necessary, adjust the steering cable.
 - Loosen the locknut [A] on the end of the steering cable located to the right of the steering nozzle.
 - Take out the cable joint bolt [B] and disconnect the cable joint [C] from the steering nozzle.
 - Center the handlebar in a straight ahead steering position.
 - Turn the joint on the cable to adjust the steering.
 - Temporarily tighten the cable joint bolt, and connect the joint with the nozzle and check cable adjustment again.
 - When adjustment is correct, unscrew the cable joint bolt and apply a non-permanent locking agent to it. And tighten the cable joint bolt and the steering cable locknut securely.



Torque - Cable Joint Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- As an additional check, turn the handlebar all the way to the left and right, and measure the distance between the nozzle and the edge of the pump cavity. It should be equal at both extremes.

Steering Cable Removal

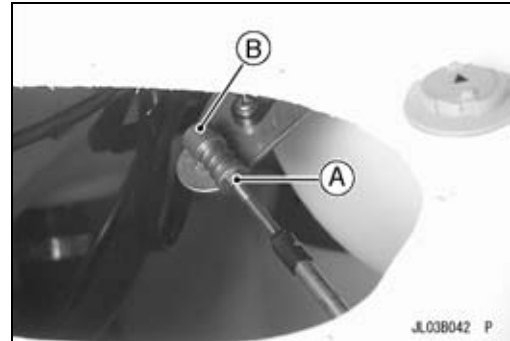
- Remove the screws [A] and remove the front storage pocket [B].



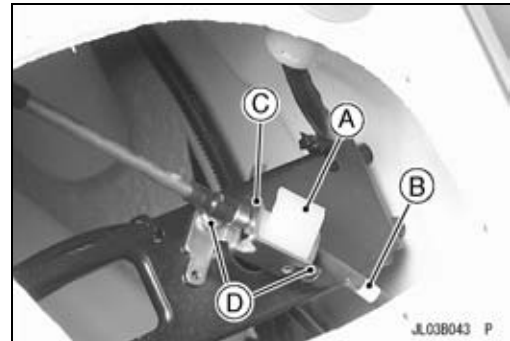
12-6 STEERING

Steering Cable

- Loosen the locknut [A] at the front end of the steering cable, and slide back the outer sleeve of the ball joint and take off the ball joint [B] and remove the locknut from the cable front end.



- Pull the holder [A] off the cable bracket.
- Slide the steering cable [B] off the cable bracket [C], and if the cable is hard to remove, unscrew the cable bracket mounting bolts [D], and remove the cable bracket.



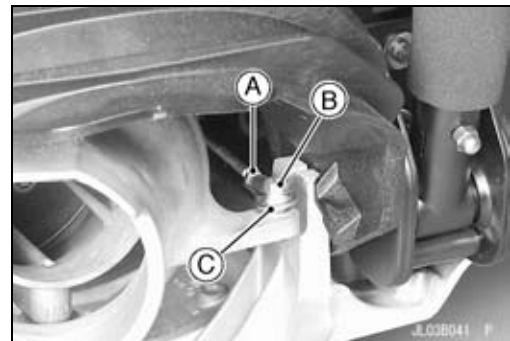
- Turn the watercraft on its left side and remove the pump cover (see Pump Removal in Pump/Impeller chapter).

CAUTION

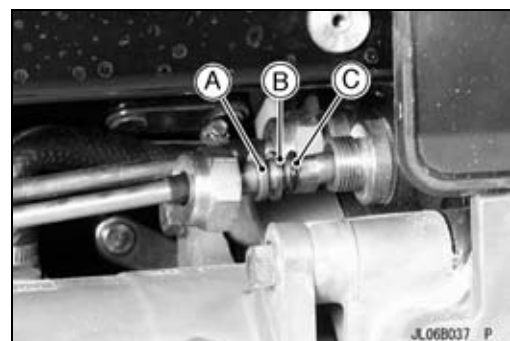
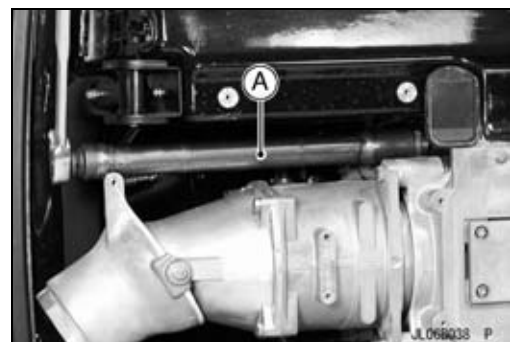
Never lay the watercraft on the right side. Water in the exhaust system may drain back into the engine, causing serious damage.

- Loosen the locknut [A] at the rear end of the steering cable, and remove the joint bolt [B].
 - Remove the joint [C] and locknut from the cable end.
 - Unscrew the large nut (steering cable nut) in the hull with a wrench.
- Special tool, box wrench [A] is useful to remove the large nut (steering cable nut).

Special Tool - Box Wrench: 57001-1451



- Slide off the snap ring [A], washer [B] and O-ring [C].
- Pull out the steering cable toward the rear.



Steering Cable

Steering Cable Installation

- Slide a short piece of rubber or plastic tubing over the front cable end to guide the cable through the hull.
- Lubricate the outside of the new cable to ease cable installation.
- Torque:
Torque - Steering Cable Nut: 39 N·m (4.0 kgf·m, 29 ft·lb)
- Apply a non-permanent locking agent to the cable joint bolt and the steering cable bracket mounting bolts, if removed.
Torque - Cable Joint Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)
- Apply a water resistant grease to the joint ball [A].
- Adjust the steering cable (see Steering Cable Adjustment).



Steering Cable Inspection

- Refer to Steering Cable Inspection in the Periodic Maintenance chapter.

Steering Cable Lubrication

NOTE

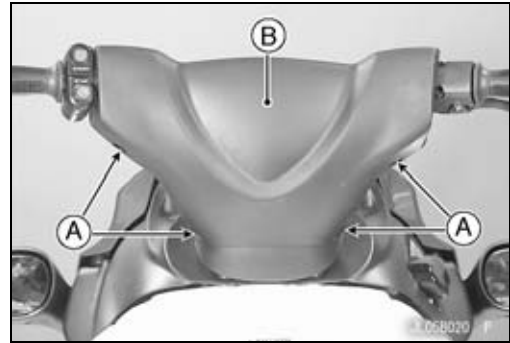
- *The steering cable is sealed at each end and do not require lubrication. If the seal is damaged, the cable must be replaced.*

12-8 STEERING

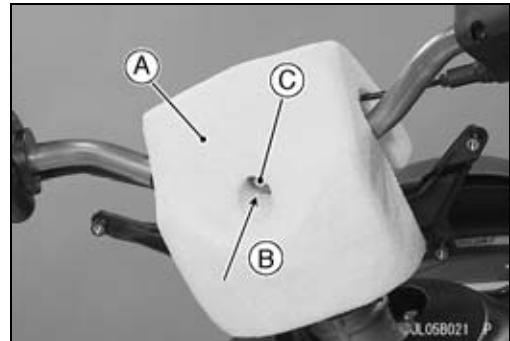
Handlebar

Handlebar Removal

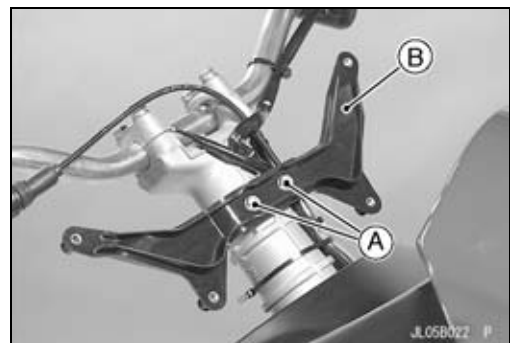
- Unscrew the mounting screws [A] and remove the handlebar pad [B].



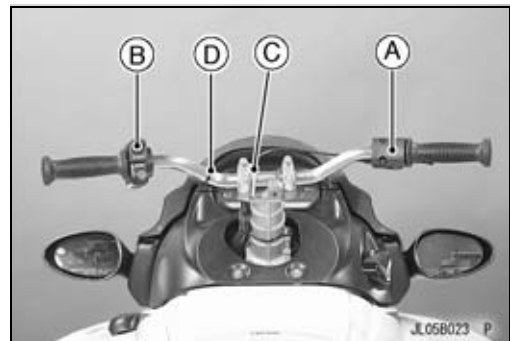
- Remove the inner pad [A], pushing [B] the buzzer [C].



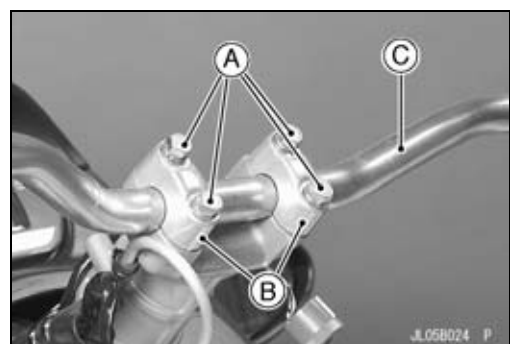
- Unscrew the bolts [A] and remove the pad holder [B].



- Take out the throttle case clamp screws and remove the throttle case [A].
- Take out the switch case clamp screws and remove the switch case [B].
- Unhook the pipe [C].
- Cut off the clamp [D].



- Unscrew the handlebar clamp bolts [A] and remove the handlebar clamps [B] and handlebar [C].

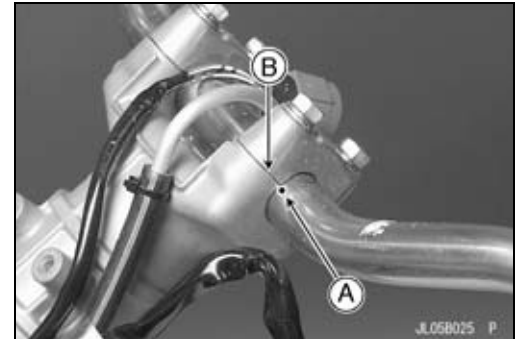


Handlebar

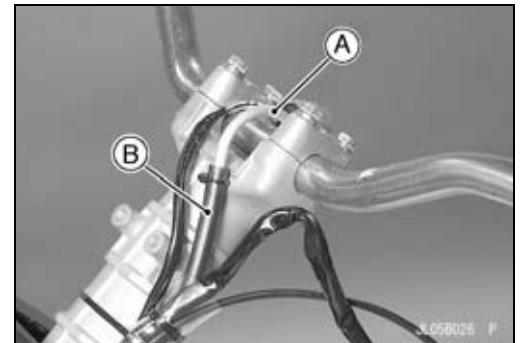
Handlebar Installation

- Install the pad holder.
- Apply a non-permanent locking agent to the pad holder bolts.
- Install the handlebar on the holder of the steering neck.
- Apply a non-permanent locking agent to the handlebar clamp bolts.
- Align the punch mark [A] on the left side of the handlebar with the parting line [B].
- Tighten the front and then rear handlebar clamp bolts to the specified torque.

Torque - Handlebar Clamp Bolts: 16 N·m (1.6 kgf·m, 12 ft·lb)



- Be sure the pipe [A] is installed on the top end of the fuel vent hose [B].

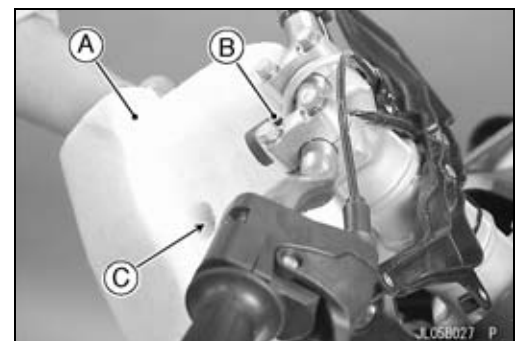


- Install the throttle case and switch case. Tighten the screws.

Torque - Throttle Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 2.9 ft·lb)

Switch Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 2.9 ft·lb)

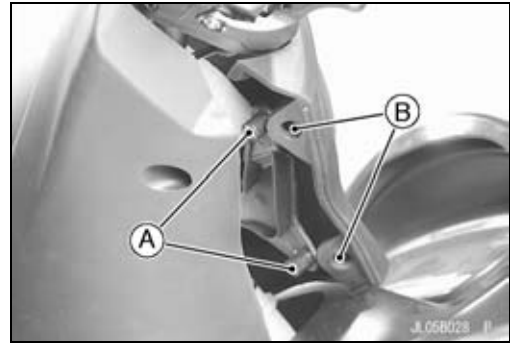
- Route the cable, wire and hose correctly (see Appendix chapter).
- Install the inner pad [A] on the handlebar, putting the buzzer [B] into the hollow [C] on the inner pad.



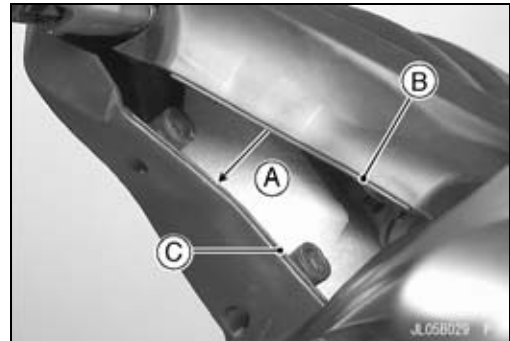
12-10 STEERING

Handlebar

- Install the bosses [A] on the pad holder to the holes [B] on the handlebar pad.



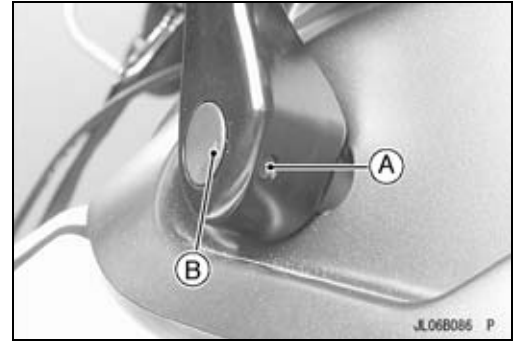
- Align [A] the projection [B] on the pad with the groove [C] on the pad.



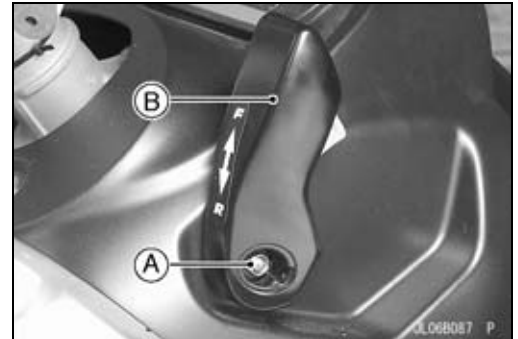
Steering

Steering Removal

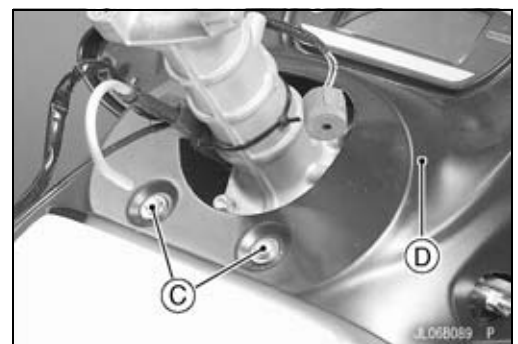
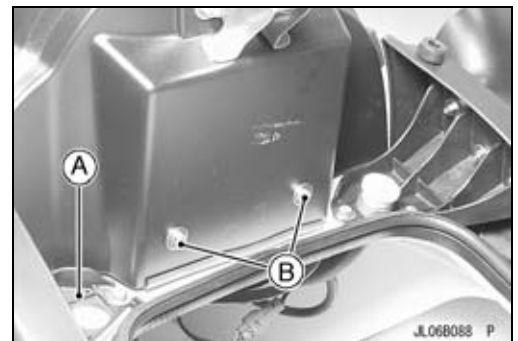
- Remove the handlebar and pad holder (see Handlebar Removal).
- Unscrew the set screw [A] and take out the cap [B].



- Unscrew the shift lever nut [A] and remove the shift lever [B].



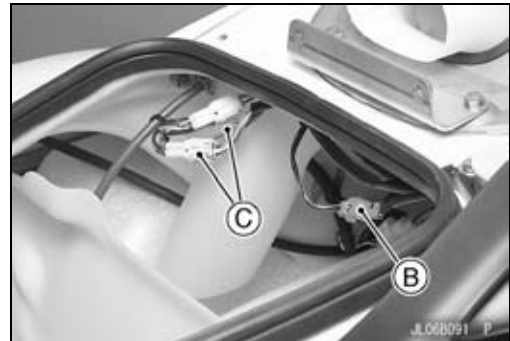
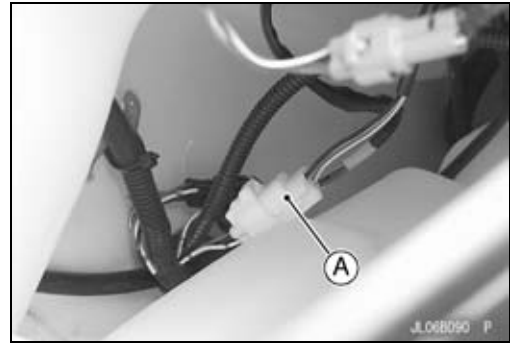
- Remove the right stay [A] with the right mirror (see Hull/Engine Hood chapter).
- Unscrew the steering cover mounting bolts [B], [C] and lift up the steering cover [D].



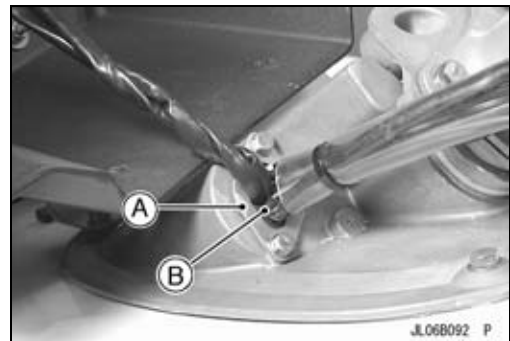
12-12 STEERING

Steering

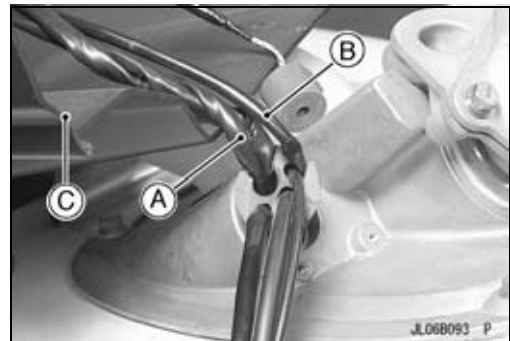
- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect:
 - Steering Position Sensor Lead Connector [A]
 - Buzzer Connector [B]
 - Multifunction Meter Lead Connectors [C]
 - Steering Cable Ball Joint at Upper End
 - Shift Cable Ball Joint at Upper End



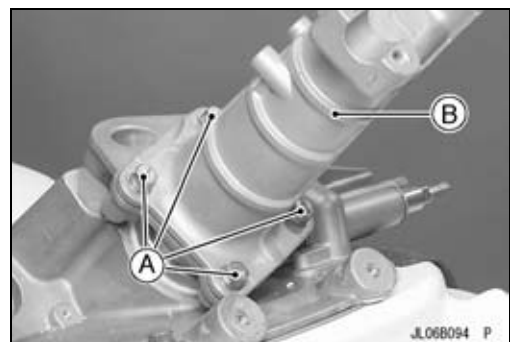
- Take out the grommet mounting plate [A] and pull the grommet [B].



- Pull out the multifunction meter leads [A] and buzzer lead [B] from the grommet.
- Remove the steering cover [C].

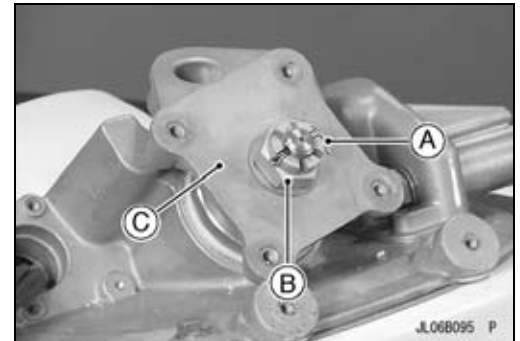


- Unscrew the steering neck mounting bolts [A] and remove the steering neck [B].

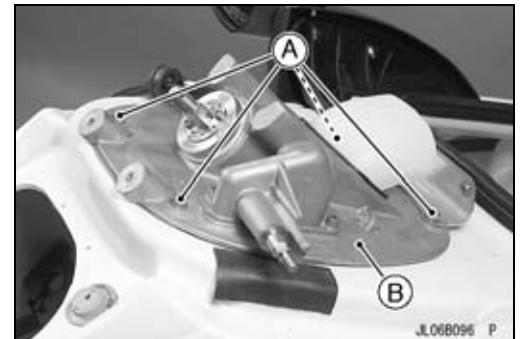


Steering

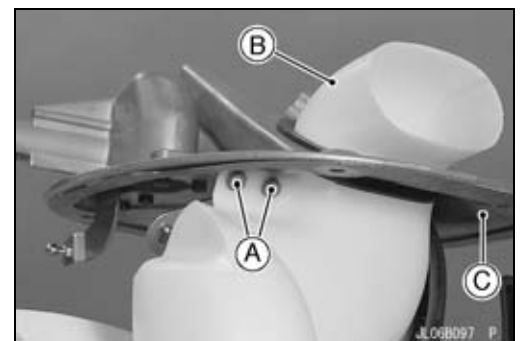
- Remove the cotter pin [A] and steering shaft locknut [B].
- Take out the holder [C].



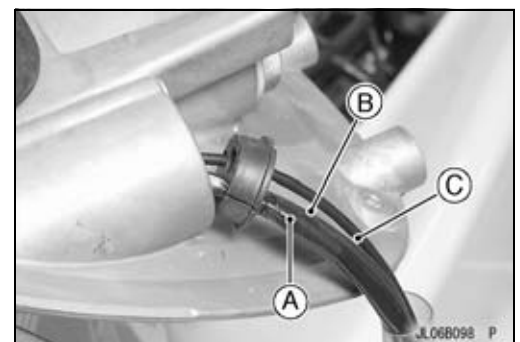
- Unscrew the steering holder mounting bolts [A], nuts, and washers, and lift up the steering holder [B].



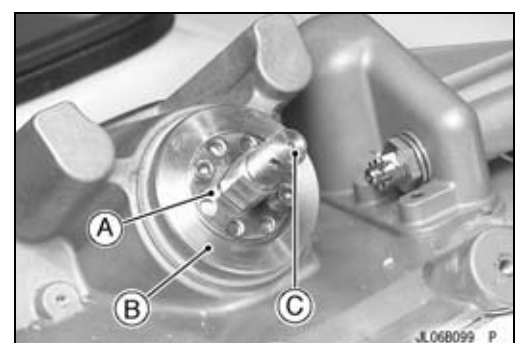
- Take out the air intake duct mounting bolts [A] and remove the air intake duct [B] from the steering holder [C].



- Disconnect the switch case lead connector and pull the leads [A] out of the hull.
- Disconnect the pipe at the fuel vent hose upper end and pull down the fuel vent hose [B].
- Disconnect the throttle cable upper end at the throttle case and pull down the throttle cable [C].



- Remove the lock plate [A].
- Take out the steering shaft nut [B] and pull down the steering shaft [C].
- Remove the steering holder.

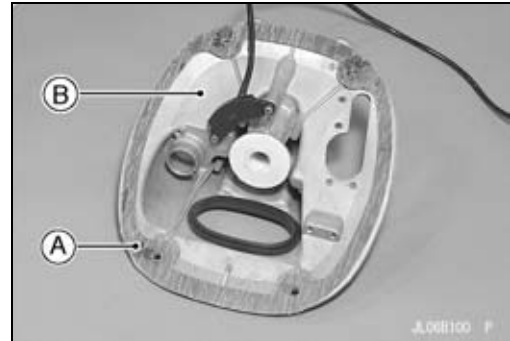


12-14 STEERING

Steering

Steering Installation

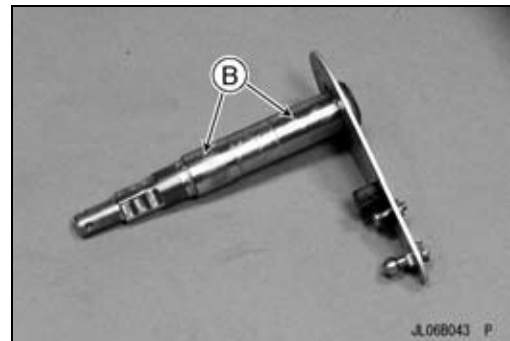
- Replace the gasket [A] on the steering holder [B] with a new one.



- Check the bushings for damage and wear before installing the steering holder.
- ★ If the bushings are damaged or worn, replace them.
- Grease:
 - Bushings [A]



Steering Shaft [B]



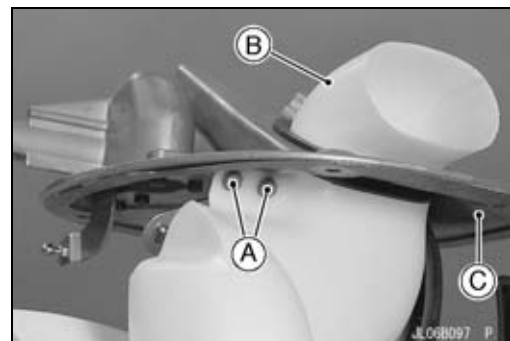
- Install the steering shaft and the steering shaft nut (Hand-Tighten) [A] to the steering holder.
- If steering is too tight, turn the steering shaft nut counterclockwise to loosen.
- If steering is too loose, turn the steering shaft nut clockwise to tighten.



NOTE

○ *The steering shaft must be turned smoothly when the cable is connected. Turn the steering shaft nut 1/6 or less turn at a time.*

- Install the air intake duct [B] to the steering holder [C].
- Apply a non-permanent locking agent to the air intake duct mounting bolts [A].



Steering

- Torque the steering shaft locknut [A].
Torque - Steering Shaft Locknut: 49 ~ 59 N·m (5.0 ~ 6.0 kgf·m, 36 ~ 43 ft·lb)

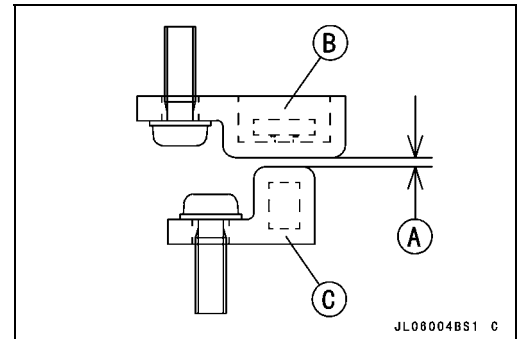


- Turning the steering shaft fully in left and right direction, check whether the steering position sensor comes in contact with the magnet.
- Check the clearance [A] between the steering position sensor [B] and the magnet [C] with feeler gauge.

Steering Position Sensor Clearance

Standard: 0.5 ~ 1.5 mm (0.02 ~ 0.06 in.)

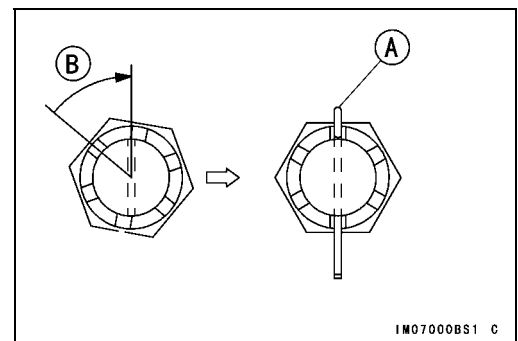
- ★ If necessary, adjust the clearance by turning the steering shaft nut.



- Replace the cotter pin [A] with a new one.

NOTE

- When inserting the cotter pin, if the slots in the locknut do not align with the cotter pin hole in the steering shaft, tighten the locknut clockwise [B] up to next alignment.
- It should be within 30 degree.
- Loosen once and tighten again when the slot goes past the nearest hole.

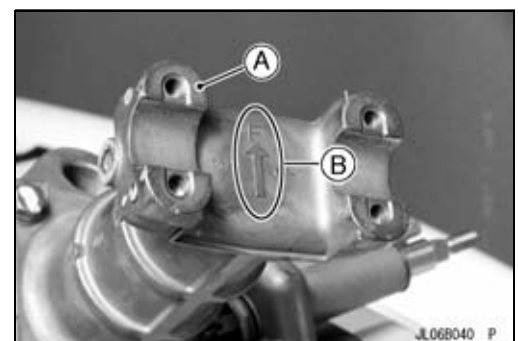


- Band the cotter pin over the nut.
- Install the steering holder.
- Apply a non-permanent locking agent to the steering holder mounting bolts.

Torque - Steering Holder Mounting Bolts: 20 N·m (2.0 kgf·m, 14.5 in·lb)

- Install the steering neck [A] so that its arrow mark [B] points toward the front.
- Apply a non-permanent locking agent to the steering neck mounting bolts.

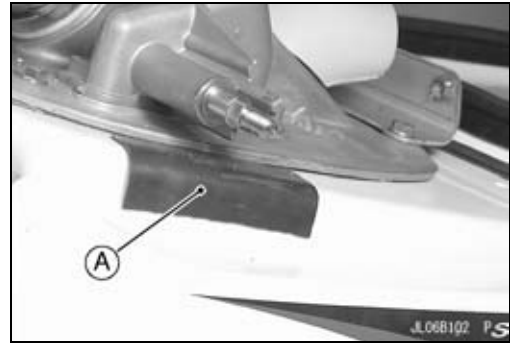
Torque - Steering Neck Mounting Bolts: 16 N·m (1.6 kgf·m, 12 ft·lb)



12-16 STEERING

Steering

- Be sure that the damper [A] is in position.

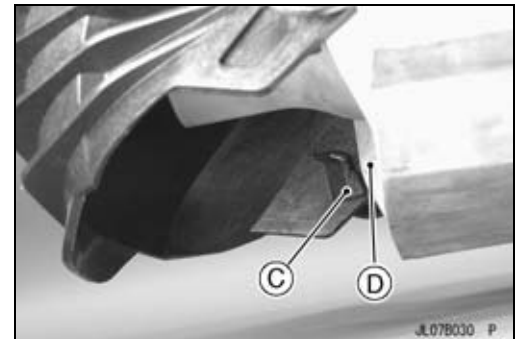
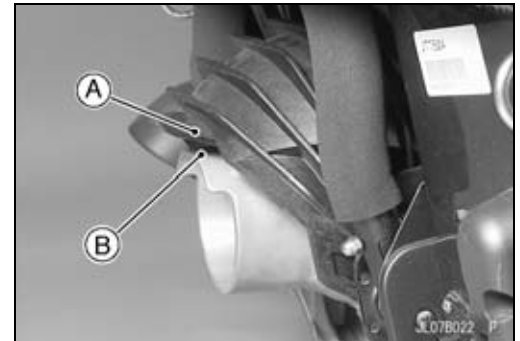


- Apply a non-permanent locking agent to the grommet mounting plate.
- Apply a non-permanent locking agent to the steering cover mounting bolts.
- Install the steering cover mounting bolts to the steering cover.
- Apply a non-permanent locking agent to the shift lever nut.
- Apply a water resistant grease to the joint balls of the shift cable and shift link rod.
- Adjust the shift cable and steering cable.

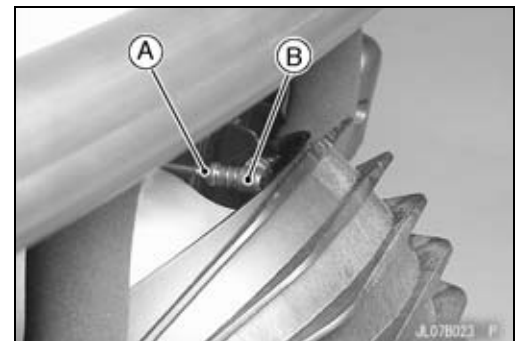
Reverse System

Shift Cable Adjustment

- Check the shift cable adjustment.
- When the shift lever is in the “F” position, the lower edge [A] of the bucket should be held above the top [B] of the steering nozzle with slight play so it doesn’t interfere with the water flow from the jet pump.
- When the shift lever is in the “R” position, the lower stopper [C] on the bucket should rest against the bottom [D] of the pump cover.



- ★ If either position is incorrect, adjust the shift cable.
- Put the shift lever in the “R” position.
- Loosen the locknut [A] at the end of the shift cable.
- Slide back the outer sleeve and take the ball joint [B] off the ball.
- Turn the ball joint on the cable to adjust the shift cable.
- Connect the ball joint and check the cable adjustment again.
- When adjustment is correct, tighten the shift cable locknut.

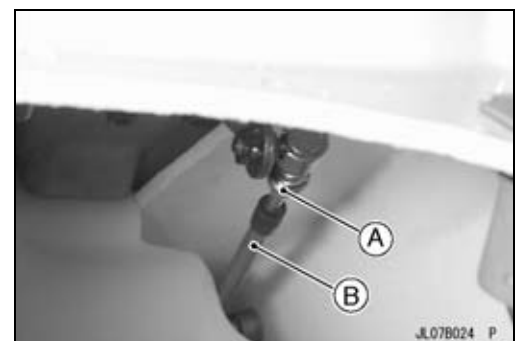


Shift Cable Removal

- Take out the storage case screws [A] and remove the storage case [B].



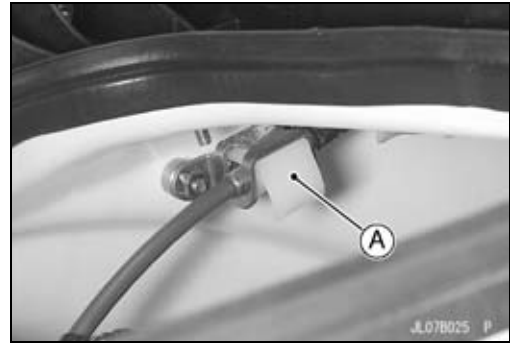
- Loosen the locknut [A] at the front end of the shift cable [B].



12-18 STEERING

Reverse System

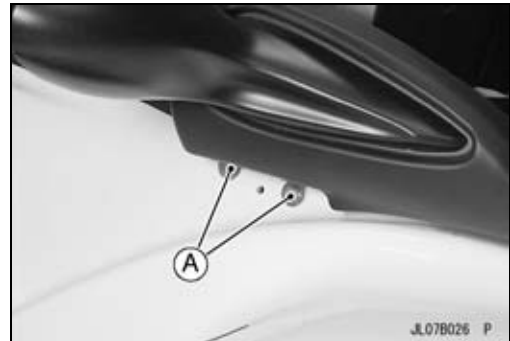
- Pull the holder [A] off the cable bracket.



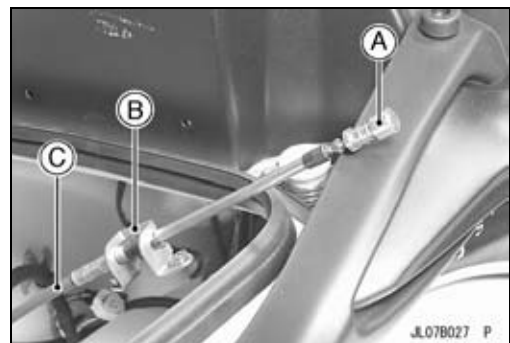
- Remove the right side cover (see Hull/Engine Hood chapter).
- Unscrew the bolts [A] and remove the cable bracket.

NOTE

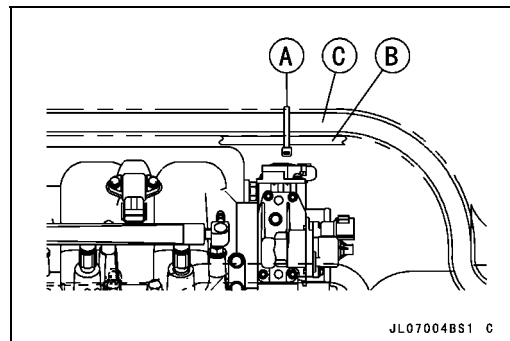
○ The collors on the inside of the hull will drip down when the bolts are removed.



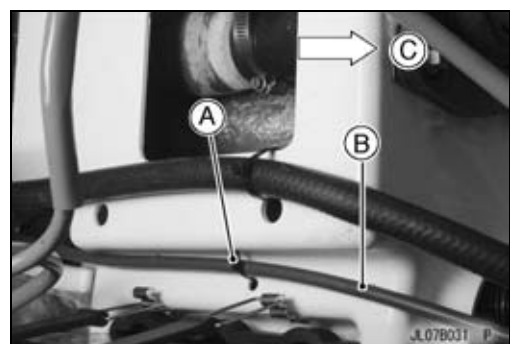
- Remove the ball joint [A] and cable bracket [B] from the shift cable [C].



- Cut off the band [A] holding the shift cable [B] and inlet cooling hose [C] for the oil cooler.



- Cut off the band [A] holding the shift cable [B].
Bow [C]



Reverse System

- Turn the watercraft on its left side and remove the pump cover (see Pump/Impeller chapter).

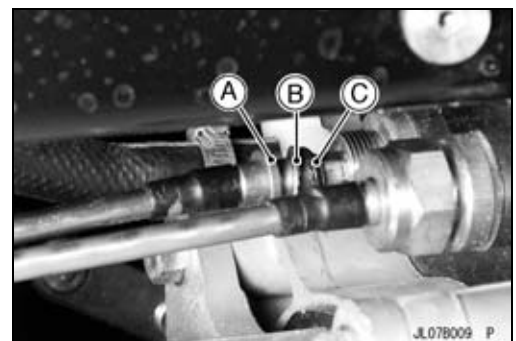
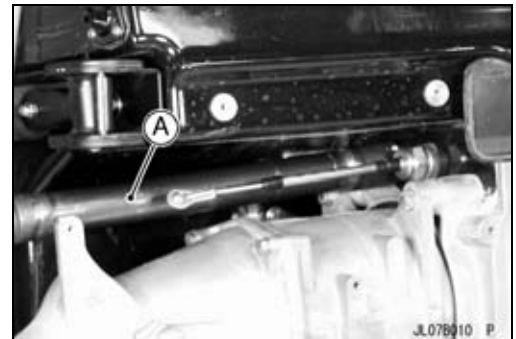
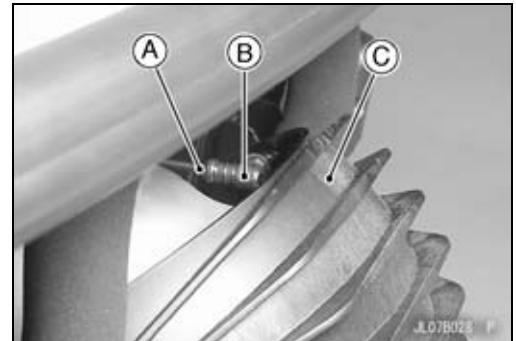
CAUTION

Never lay the watercraft on the right side. Water in the exhaust system may drain back into the engine, causing serious damage.

- Loosen the locknut [A] at the rear end of the shift cable, and remove the ball joint [B] from the reverse bucket [C],
- Disconnect the shift cable from the fitting at the middle of the hull.
- Unscrew the large nut (shift cable nut) in the hull with a wrench.
- Special tool, box wrench [A] is useful to remove the large nut (shift cable nut).

Special Tool - Box Wrench: 57001-1451

- Pull the cable from the cable detente in the engine compartment.
- Slide off the snap ring [A], washer [B] and O-ring [C].
- Pull out the shift cable toward the rear.



Shift Cable Installation

- Slide a short piece of rubber or plastic tubing over the front cable end to guide the cable through the hull.
- Lubricate the outside of the new cable to ease cable installation.
- Torque the shift cable nut.

Torque - Shift Cable Nut: 39 N·m (4.0 kgf·m, 29 ft·lb)
- Apply a non-permanent locking agent to the cable bracket mounting bolt.
- Apply a water resistant grease to the joint ball at each end of shift cable.
- Adjust the shift cable (see Shift Cable Adjustment).

Shift Cable Inspection

- Refer to Steering Cable/Shift Cable Inspection in the Periodic Maintenance chapter.

Shift Cable Lubrication

NOTE

- *The shift cable is sealed at each end and do not require lubrication. If the seal is damaged, the cable must be replaced.*

12-20 STEERING

Reverse System

Reverse Bucket Removal/Installation

- Disconnect the ball joint at rear end of the shift cable.
- Remove the pump cover.
- Unscrew the pivot bolts [A] and remove the reverse bucket [B].
- Installation is the reverse of removal. Note the following.
- Apply a non-permanent locking agent to the reverse bucket pivot bolts, and torque them.

Torque - Reverse Bucket Pivot Bolts: 19 N·m (1.9 kgf·m, 14 ft·lb)

- After installation, check the shift cable adjustment.

Shift Lever Shaft Removal/Installation

- Remove:
 - Steering Cover (see Steering Removal)
 - Steering Cable Ball Joint at Upper End (disconnect)
- Unscrew the mounting bolts [A] on the inside of the hull and remove the shift lever holder [B].

- Assemble the shift lever holder, noting the following.
- Grease:
 - Shift Lever Shaft [A]
 - Bushings [B]
- Apply silicone sealant to the mating surface between the shift lever holder bottom and steering holder upper surface.
- Apply a non-permanent locking agent to the lever nut [C] and the shift lever holder mounting bolts [E].
- Torque the shift lever locknut [D].

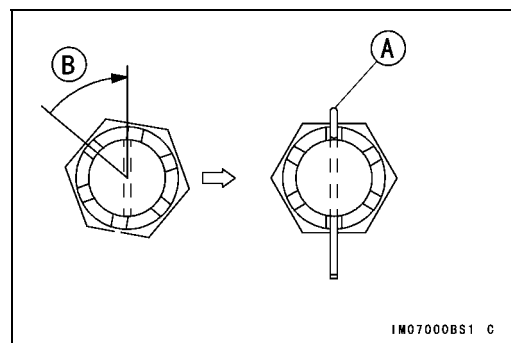
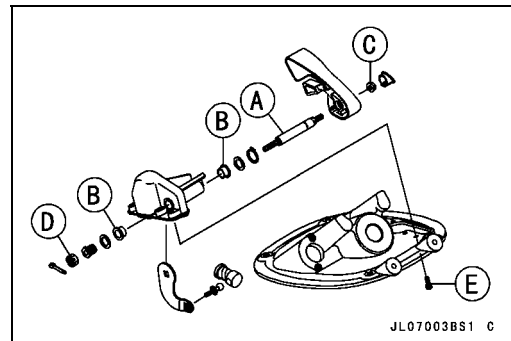
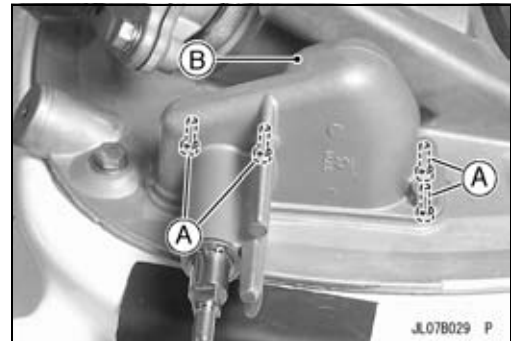
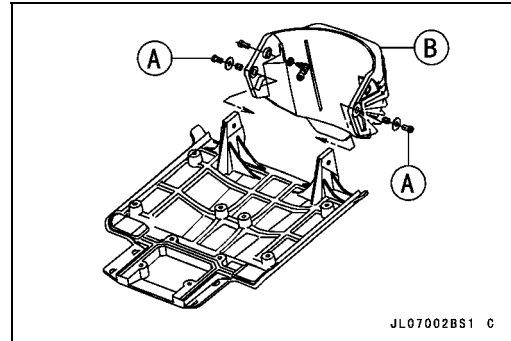
Torque - Shift Lever Locknut: 20 N·m (2.0 kgf·m, 14.5 ft·lb)

- Replace the cotter pin [A] with a new one.

NOTE

- When inserting the cotter pin, if the slots in the locknut do not align with the cotter pin hole in the steering shaft, tighten the locknut clockwise [B] up to next alignment.
- It should be within 30 degree.
- Loosen once and tighten again when the slot goes past the nearest hole.

- Bend the cotter pin over the nut.
- Before connecting the shift and steering cables, apply a water resistant grease to their joint balls.



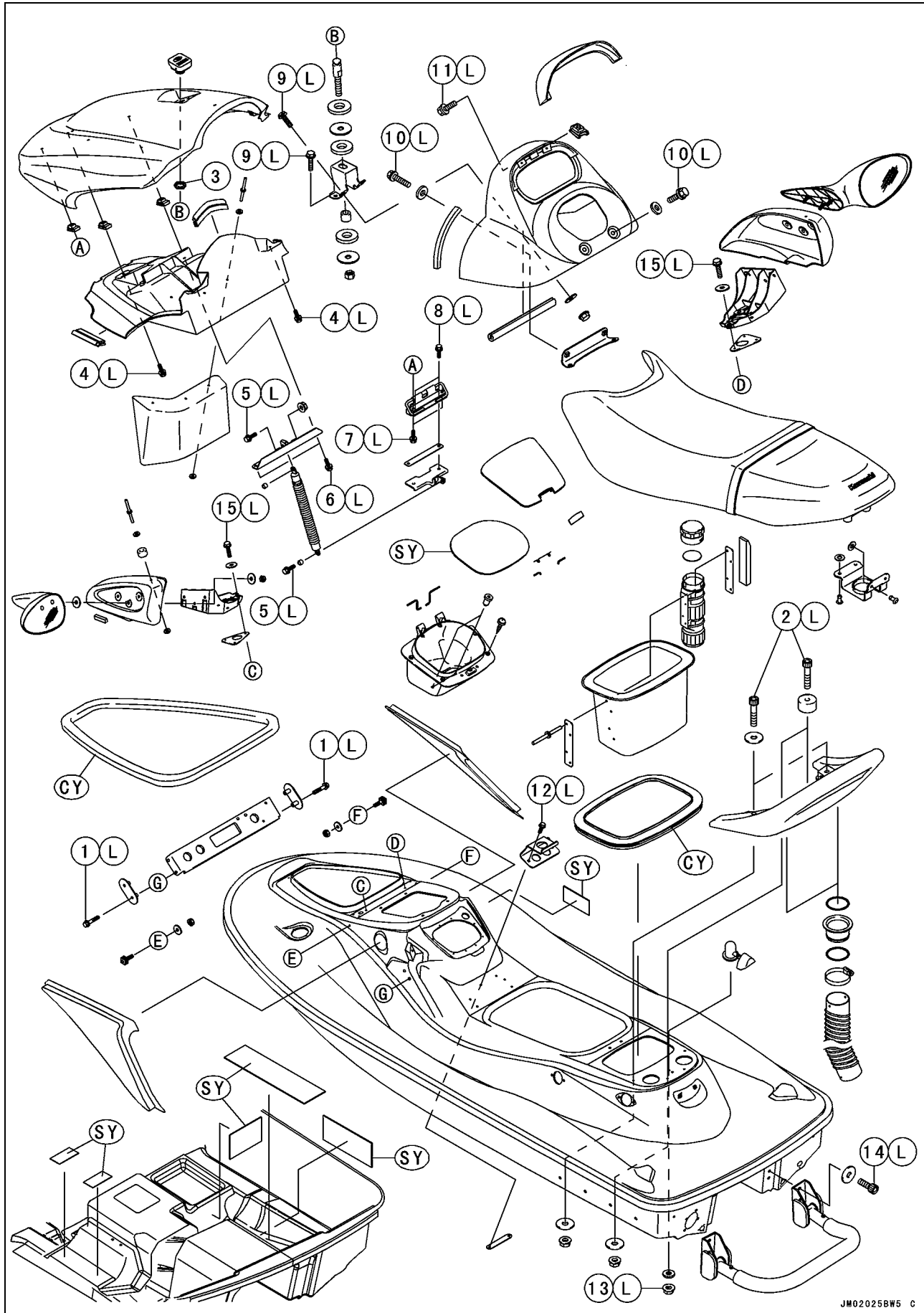
Hull/Engine Hood

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13-2 HULL/ENGINE HOOD

Exploded View



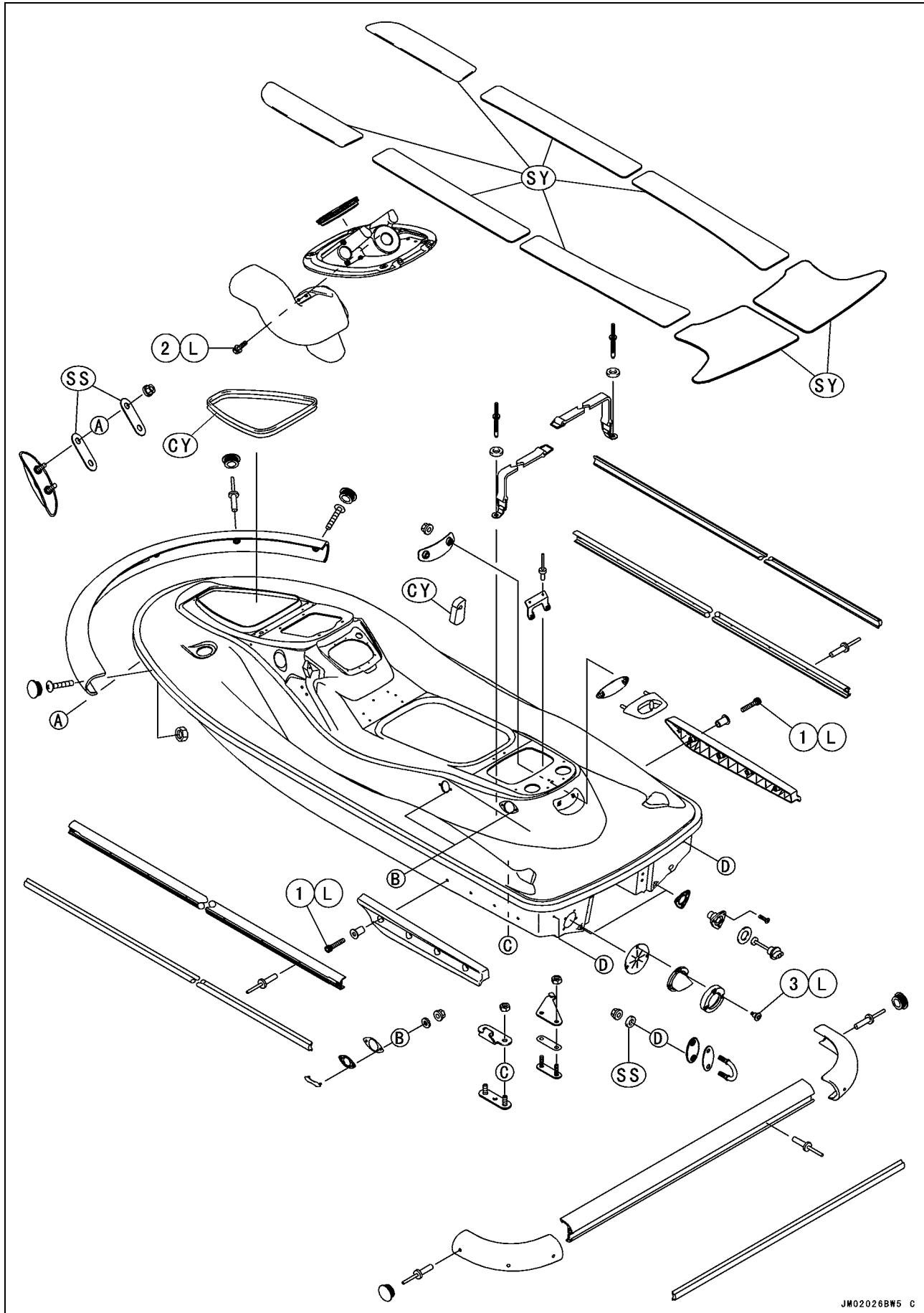
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Crossmember Bolts	7.8	0.80	69 in·lb	L
2	Handrail Bolts	9.8	1.0	87 in·lb	L
3	Lock Assembly Nut	4.9	0.50	43 in·lb	
4	Front Duct Bolts	–	–	–	L
5	Damper Bolts	–	–	–	L
6	Damper Bracket Bolts	–	–	–	L
7	Front Storage Compartment Cover Bolts	–	–	–	L
8	Hinge Bolts	–	–	–	L
9	Front Storage Compartment Hook Bolts	–	–	–	L
10	Steering Cover Bolts	–	–	–	L
11	Meter Screen Bolts	–	–	–	L
12	Seat Hook Bolts	–	–	–	L
13	Seat Locknut	–	–	–	L
14	Reboarding Step Bolts	–	–	–	L
15	Mirror Stay Bolts	–	–	–	L

- CY: Apply cyanoacrylate cement.
- L: Apply a non-permanent locking agent.
- SY: Apply synthetic rubber adhesive.

13-4 HULL/ENGINE HOOD

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Stabilizer Bolts	9.8	1.0	87 in·lb	L
2	Air Inlet Duct Bolts	–	–	–	L
3	Exhaust Outlet Bolts	–	–	–	L

CY: Apply cyanoacrylate cement.

L: Apply a non-permanent locking agent.

SS: Apply silicone sealant.

SY: Apply synthetic rubber adhesive.

13-6 HULL/ENGINE HOOD

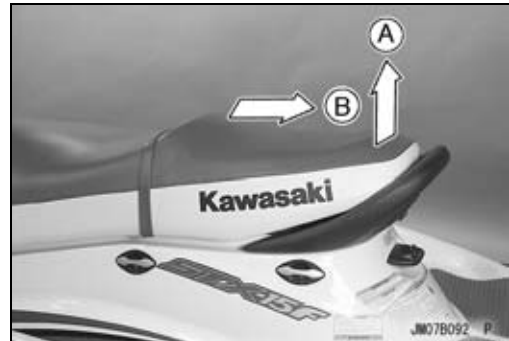
Fittings

Seat Removal

- Pull [A] the latch handle [B].

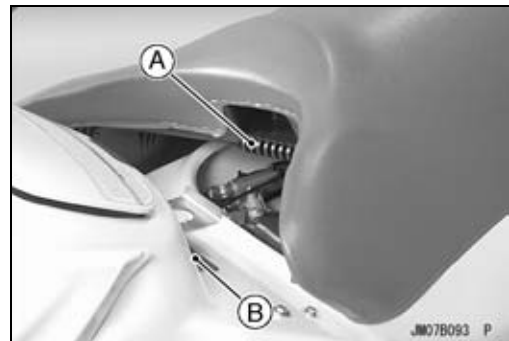


- Remove the seat up [A] and to the rear [B].



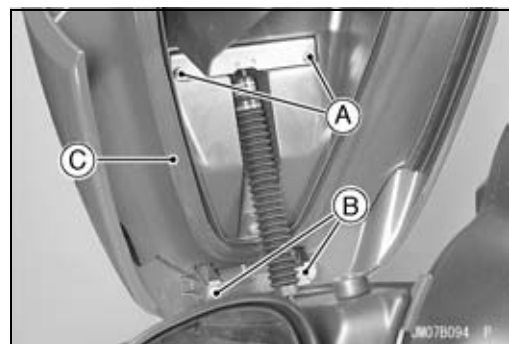
Seat Installation

- Insert the seat hook [A] into the bracket [B] on the deck and slide it all the way forward by pushing the rear of the seat.
- Push down on the rear of the seat to lock it.



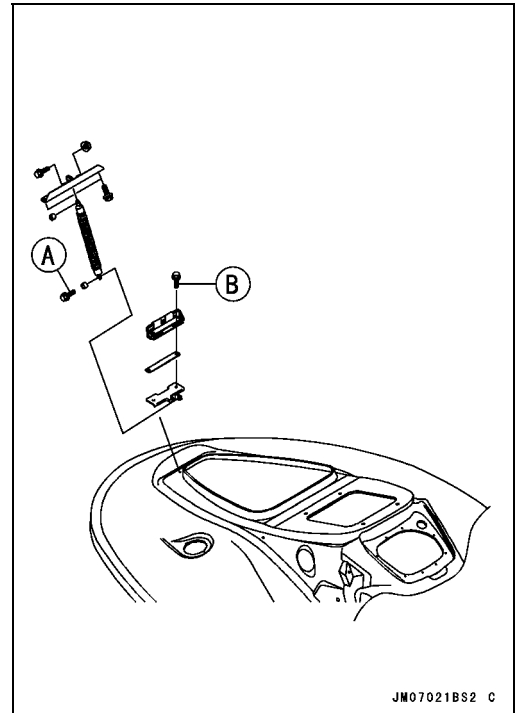
Front Storage Compartment Cover Removal

- Remove:
 - Damper Bracket Mounting Bolts [A]
 - Front Storage Compartment Cover Bracket Mounting Bolts [B]
 - Front Storage Compartment Cover Assembly [C]



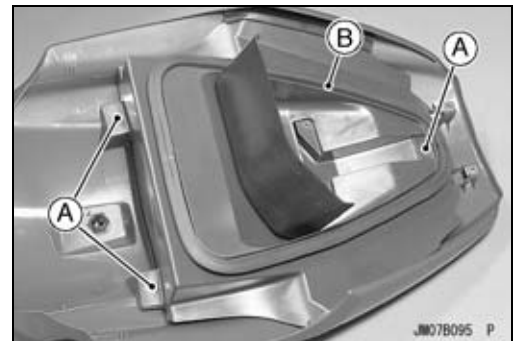
Fittings

- To remove the hinge assembly, remove the following.
 Damper Bolt [A]
 Hinge Bolts [B]

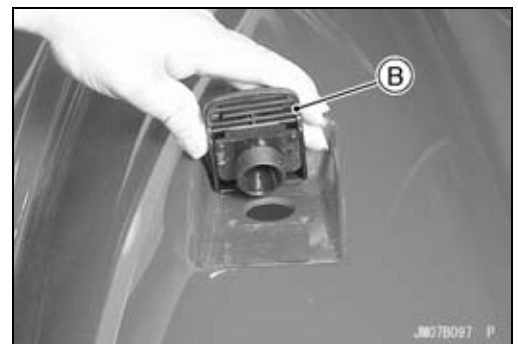
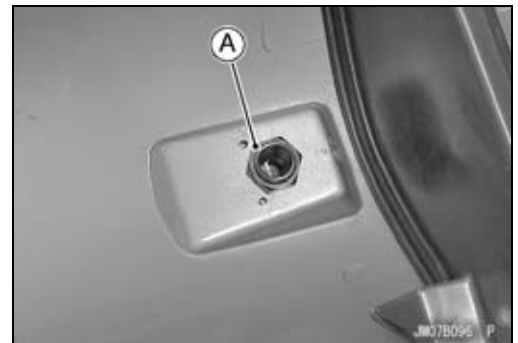


Front Storage Compartment Cover Disassembly

- Unscrew the front duct bolts [A] and remove the front duct [B].



- Unscrew the lock assembly nut [A] and remove the lock assembly [B].



13-8 HULL/ENGINE HOOD

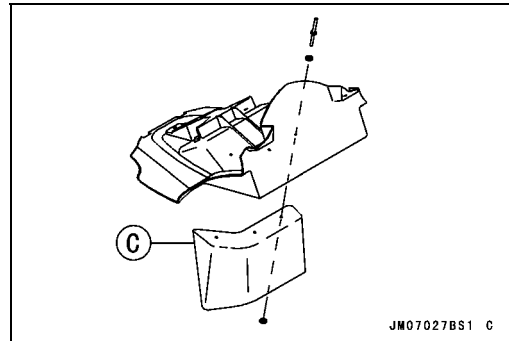
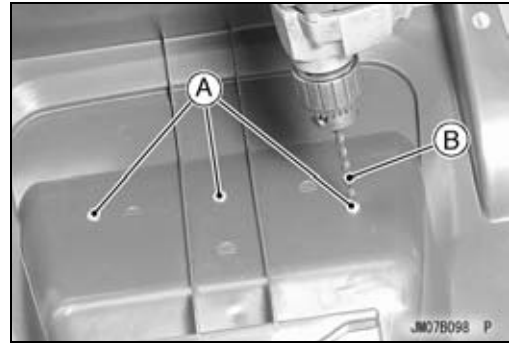
Fittings

- Drill out the rivets [A] with a drill bit [B] of the correct size and remove the front duct cover [C].

Rivet Removal Drill Bit Size
5.0 mm (0.2 in.)

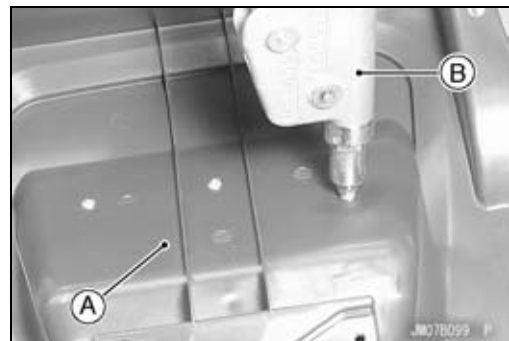
NOTE

- Stop drilling when the rivet head starts to turn with drill bit.
- Tap the rivet out with a suitable punch and hammer.

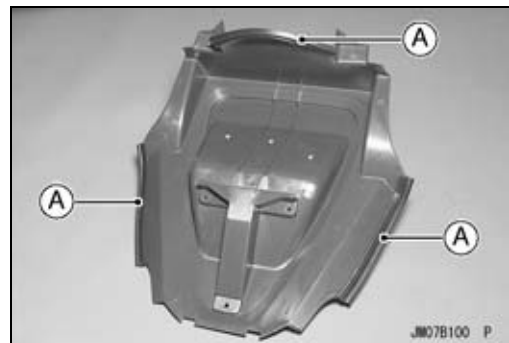


Front Storage Compartment Cover Assembly

- Secure the front duct cover to the front duct [A] with the rivets using a riveter [B].



- Be sure that the trim seals [A] are in position.

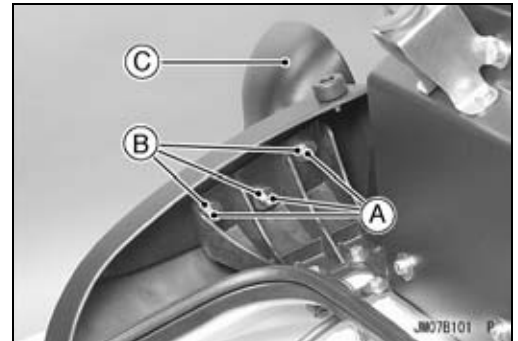


- Torque the lock assembly nut.
Torque - Lock Assembly Nut: 4.9 N·m (0.50 kgf·m, 43 in·lb)
- Apply a non-permanent locking agent to the following bolts.
 - Air Duct Bolts
 - Hinge Bolts
 - Damper Bolts

Fittings

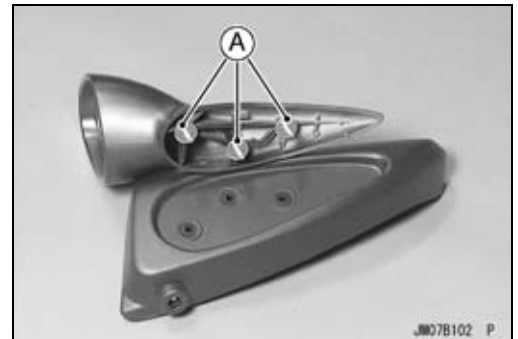
Mirror Removal

- Open the front storage compartment cover.
- Unscrew the nuts [A] and washers [B] and remove the mirrors [C] (both sides).



Mirror Installation

- Be sure that the washer [A] are in position.



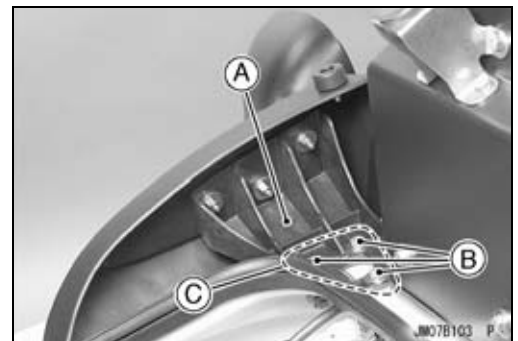
Mirror Stay Removal

- To remove the right mirror stay [A], remove the bolts [B].

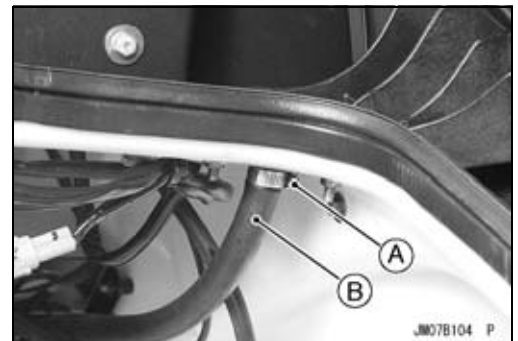
NOTE

○The plate [C] on the inside of the hull will drop down when the last bolt is removed.

- Remove the right mirror (see Mirror Removal).



- To remove the left mirror stay, perform the next procedures.
- Loosen the clamp [A] and disconnect the flushing hose [B].

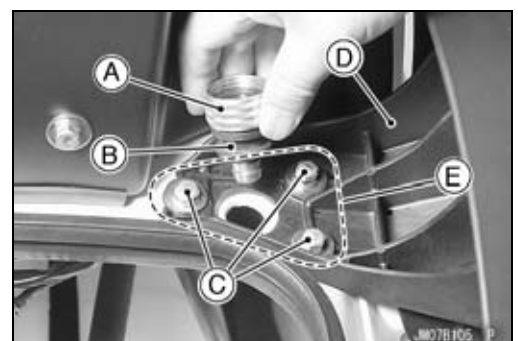


- Remove the flushing cap.
- Pull up the flushing fitting [A] with the damper [B] from the hull.
- Unscrew the bolt [C] and remove the left mirror stay [D].

NOTE

○The plate [E] on the inside of the hull will drop down when the last bolt is removed.

- Remove the left mirror (see Mirror Removal).

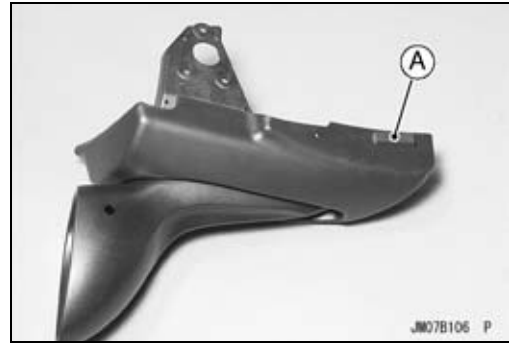


13-10 HULL/ENGINE HOOD

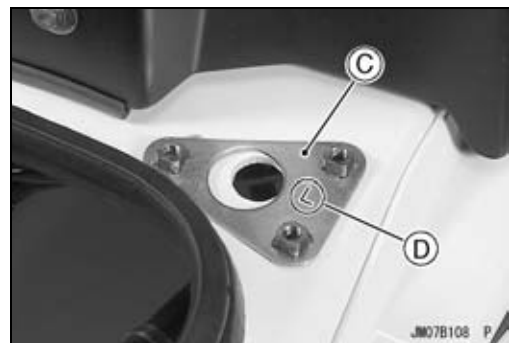
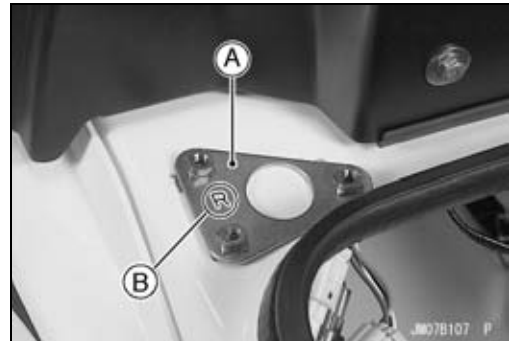
Fittings

Mirror Stay Installation

- Be sure the dampers [A] are in position (both sides).



- The right plate [A] on the inside of the hull has a R mark [B] and the left plate [C] has L mark [D].
- Apply a non-permanent locking agent to the mirror stay bolts and tighten them securely.



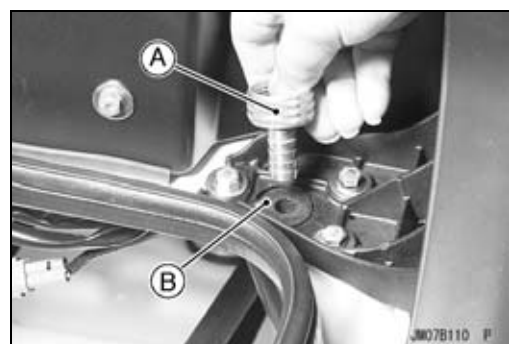
- Install the damper [A] onto the hull.

NOTE

○ Apply a little oil to the damper to make installation easy.



- Install the flushing fitting [A] into the damper [B].



Fittings

Front Storage Pocket Removal

- Remove the front storage pocket mounting screws [A].
- Remove the front storage pocket [B].

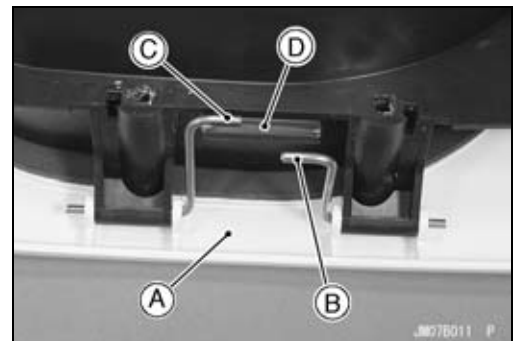


Front Storage Pocket Installation

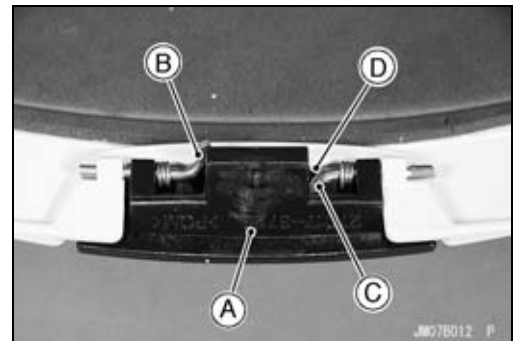
- Installation is the reverse of removal.

Storage Pocket Disassembly/Assembly

- To remove the storage pocket cover [A], turn and pull out the shaft [B] (both side).
- When installing the shafts, put the shaft end [C] (both side) into the hollow [D] on the storage pocket.

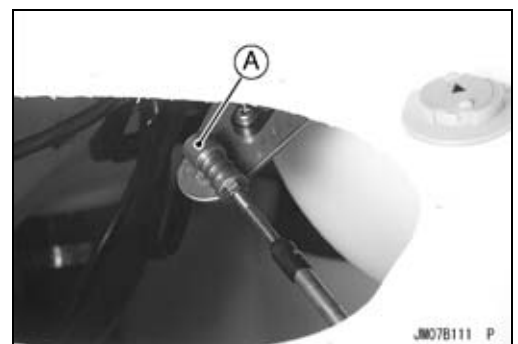


- To remove the rock [A], turn and pull out the shaft [B] (both side).
- When installing the shafts, push the shaft end [C] (both side) into the hollow [D] on the rock.



Crossmember Removal

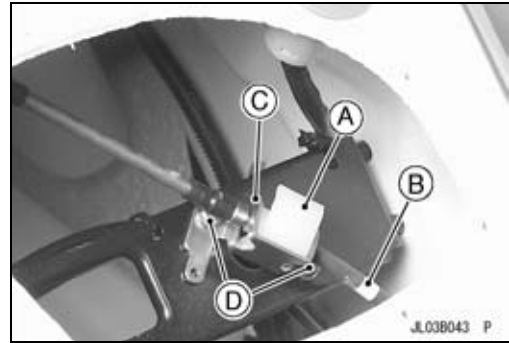
- Remove the front storage pocket (see Front Storage Pocket Removal).
- Disconnect the steering cable upper end [A].



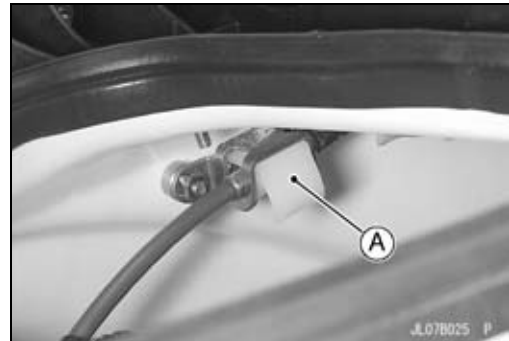
13-12 HULL/ENGINE HOOD

Fittings

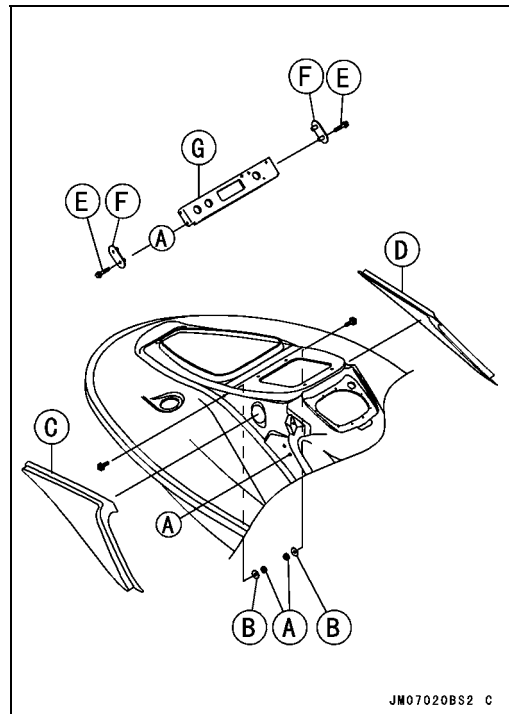
- Pull out the holder [A].
- Unscrew the mounting bolts [D] and remove the cable bracket [C] with the cable [B].



- To remove the right side cover, pull the holder [A] off the cable bracket.



- Unscrew the mounting nuts [A] and washers [B] and the left [C] and right [D] covers.
- Unscrew the crossmember bolts [E] and bracket [F], and remove the crossmember [G].



Crossmember Installation

- Apply a non-permanent locking agent to the crossmember bolts and torque them.

Torque - Crossmember Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

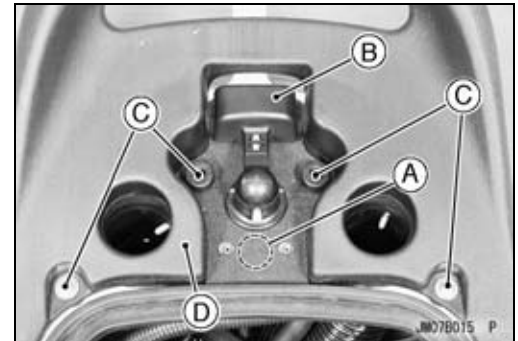
- Be sure that the dampers [A] are in position.
- Apply a non-permanent locking agent to the cable bracket mounting bolts and tighten them securely.



Fittings

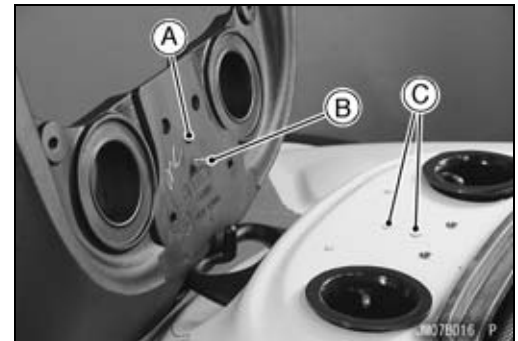
Handrail Removal

- Remove the seat (see this chapter).
- Disconnect the bilge hoses from the breather fitting.
- Unscrew the mounting nut [A] and washer inside the hull, and remove the lock assembly [B].
- Holding the nuts and washers inside hull, unscrew the mounting bolts [C], and remove the handrail [D].



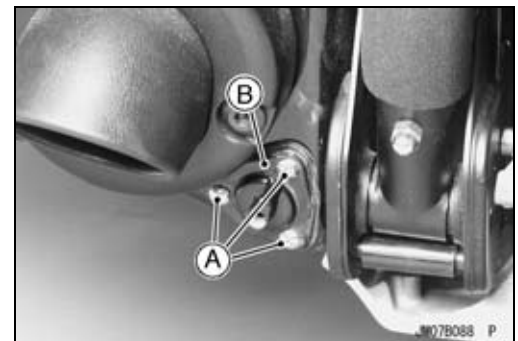
Handrail Installation

- When installing the lock assembly and handrail, align the projection [A] and stud bolt [B] on the lock assembly with holes [C] on the hull.



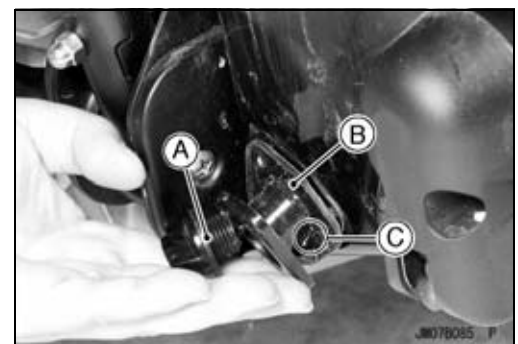
Drain Plug Housing Removal

- Unscrew the screws [A] and remove the drain plug housing [B].



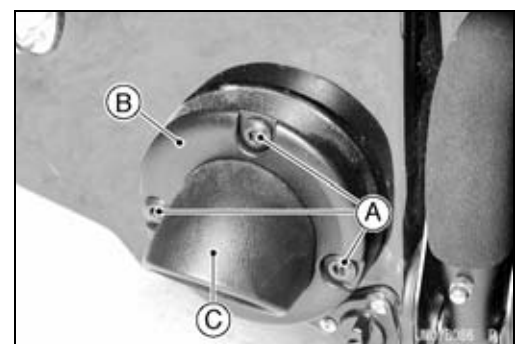
Drain Plug Housing Installation

- Check the seal [A] for damage.
- ★ If necessary, replace new ones.
- Install the new gasket [B] so that its “OUT” mark [C] faces outwards.



Exhaust Outlet Removal

- Unscrew the mounting bolts [A] and remove the holder [B] and exhaust outlet [C].



Exhaust Outlet Installation

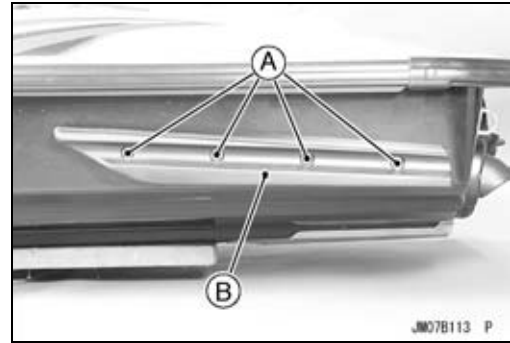
- Apply a non-permanent locking agent to the mounting bolts and tighten them securely.

13-14 HULL/ENGINE HOOD

Fittings

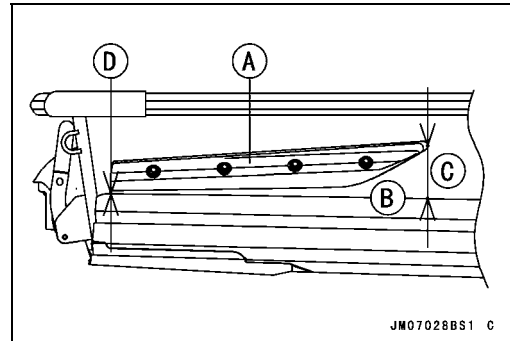
Stabilizer Removal

- Unscrew the stabilizer bolts [A] and remove the stabilizer [B].



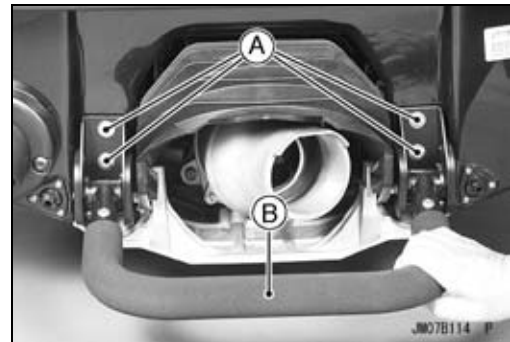
Stabilizer Installation

- Install the stabilizer as shown.
 - Stabilizer [A]
 - Chine Line [B]
 - 111 ±3 mm (4.37 ±0.12 in.) [C]
 - 8 ±2 mm (0.31 ±0.08 in.) [D]
- Apply a non-permanent locking agent to the stabilizer bolt and torque them.
Torque - Stabilizer Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



Reboarding Step Removal

- Unscrew the reboarding step bolts [A] and remove the reboarding step [B].



Reboarding Step Installation

- Apply a non-permanent locking agent to the reboarding step bolts and tighten them securely.

Hull Replacement

To replace the hull, remove the various parts in the following suggested order.

- Battery and Pad
- Exhaust Pipe and Expansion Chamber
- Inlet Manifold
- Engine and Mounts
- Air Filter
- Water Box Muffler
- Drive Shaft and Shaft Holder
- Pump and Hoses
- Steering Cover
- Handlebar and Steering
- Steering Cable
- Reverse Cable
- Crossmember
- Fuel Tank and Filler
- Bilge and Cooling System Hose
- Bypass Hose and Outlet
- Bumpers
- Engine Hood Latch
- Front Storage Compartment Cover and Brackets
- Handgrip

The following parts cannot be removed from the hull and must be replaced.

- Decals
- Labels
- Mats
- Registration Number (if any)

If the new hull is to be painted, do that first. Then install removed parts in the reverse order of their removal. Finally, install the labels, decals, mats and the registration numbers.

13-16 HULL/ENGINE HOOD

Rubber Parts

NOTE

○The rubber parts on the watercraft are fastened in place with various adhesives. To replace a rubber part, use a cement in the following table, or an equivalent.

⚠ WARNING

Read all warnings and cautions on any solvents and adhesives used. Many of these products are flammable, may be harmful to the skin and eyes, and may give off harmful vapors. Use these solvents and adhesives only in a well-ventilated area and never near an open flame.

For this Application	Type
Mats	Synthetic Rubber
Engine Hood Gasket	Adhesive
Front Storage Compartment Cover	(P/N: 92104-3701)
Trim Seal	
Detents	Cyanoacrylate Cement
Handlebar Grips	

CAUTION

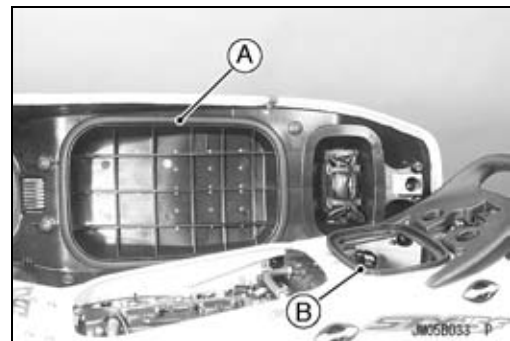
Be very careful that the part is positioned correctly when you apply the cement. It may be impossible to reposition the part.

⚠ WARNING

Do not get any cyanoacrylate cement in your eyes or on your skin. If you do get some in your eyes, do not try to wash it out. Contact a physician immediately! If you do get some on your fingers, do not touch any other part of your body; your fingers will stick to anything they touch. Allow the cement to cure and it will eventually wear off.

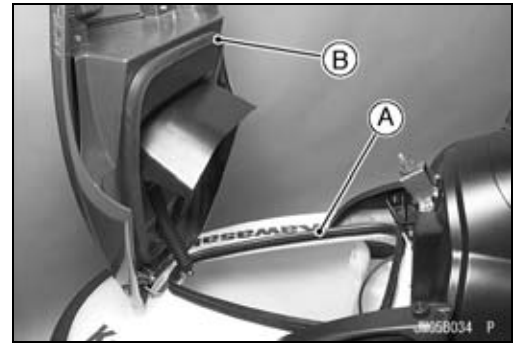
Rubber Parts Location

- Engine Hood Gasket [A]
- Rear Storage Trim Seal [B]

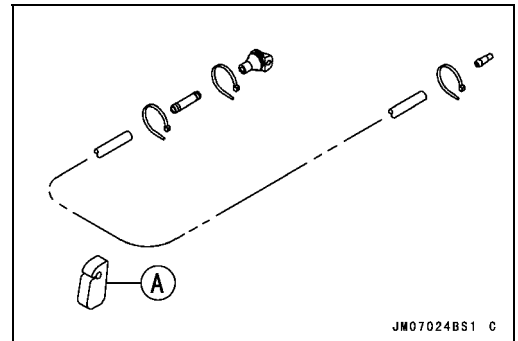


Rubber Parts

Front Storage Compartment Gasket [A]
Front Storage Compartment Cover Trim Seal [B]



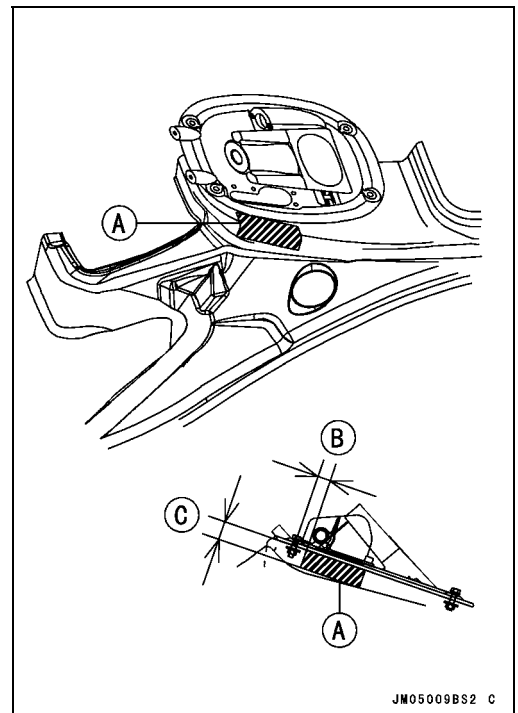
Detent [A]



Mats [A]



Damper on Deck [A] (starboard side only)
20 mm (0.79 in.) [B]
30 mm (1.18 in.) [C]



13-18 HULL/ENGINE HOOD

Rubber Parts

Rivet Removal

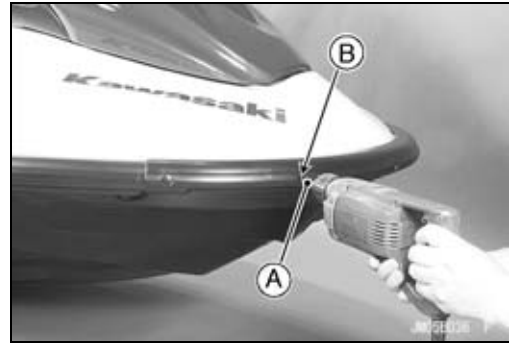
- Drill out the rivet with a drill bit [A] of the correct size.

Rivet Removal Drill Bit Size

5.0 mm (0.2 in.)

NOTE

- Stop drilling when the rivet head [B] starts to turn with drill bit.
- Tap the rivet out with a suitable punch and hammer.



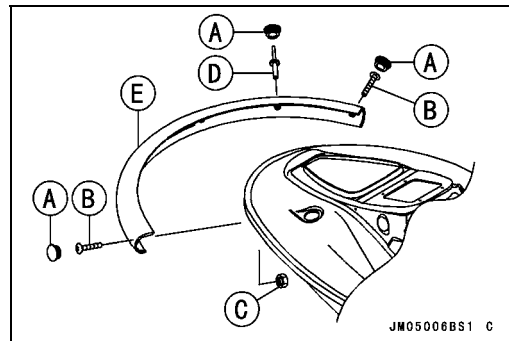
Rivet Installation

- Secure the parts to the hull with the rivets using a riveter [A].



Front Bumper Removal

- Take out the plugs [A].
- Take out the mounting screw [B] and nuts [C].
- Drill out the rivets [D] (see Rivet Removal).
- Remove the front bumper [E].

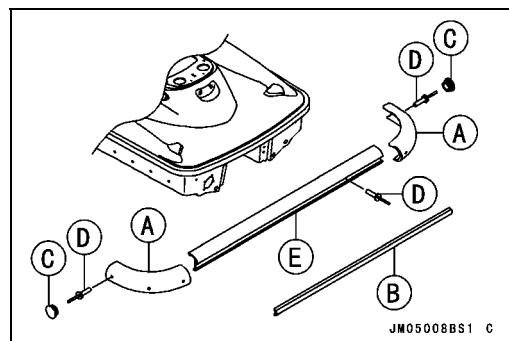


Front Bumper Installation

- Secure the front bumper to the hull flange with the rivets (see Rivet Installation).

Rear Bumper Removal

- Remove the corner bumpers [A] and trim strip [B].
- Take out the plugs [C].
- Drill out the rivets [D] (see Rivet Removal).
- Remove the rear bumper [E].



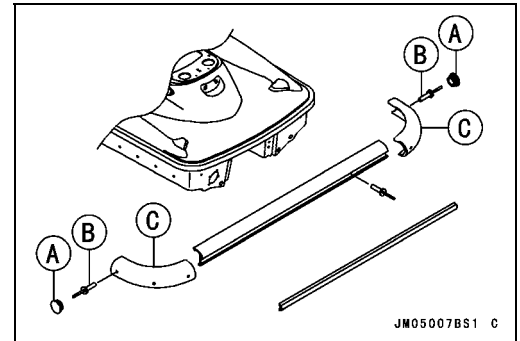
Rear Bumper Installation

- Secure the bumpers to the hull flange with the rivets (see Rivet Installation).

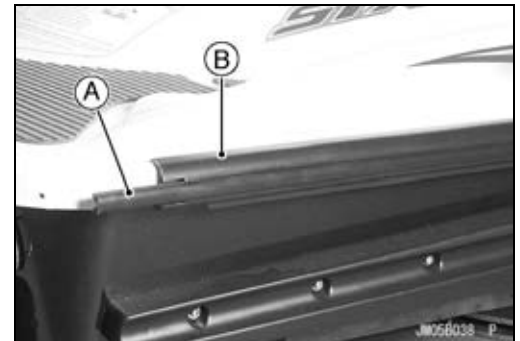
Rubber Parts

Side Bumper Removal

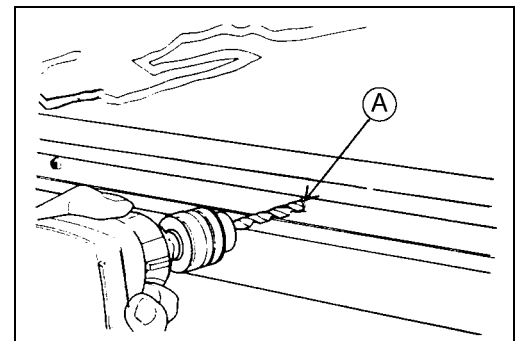
- Take out the plugs [A].
- Drill out the rivets [B] (see Rivet Removal).
- Remove the corner bumper [C].



- Remove the trim strip [A] from the side bumper [B].



- Drill out the rivets [A] (see Rivet Removal).



Side Bumper Installation

- Secure the side bumpers to the hull flange with the rivets (see Rivet Installation).
- Install the trim strip.

Electrical System

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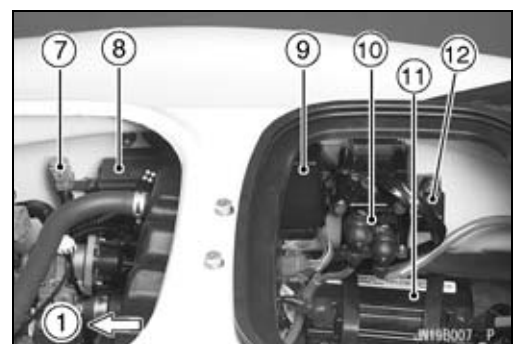
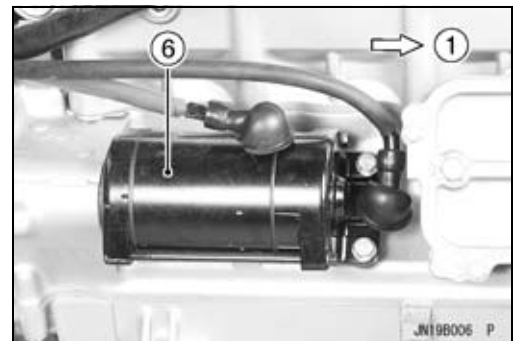
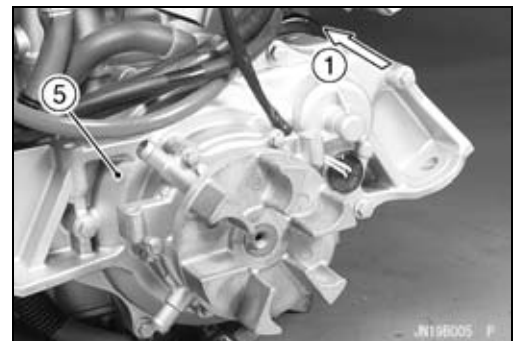
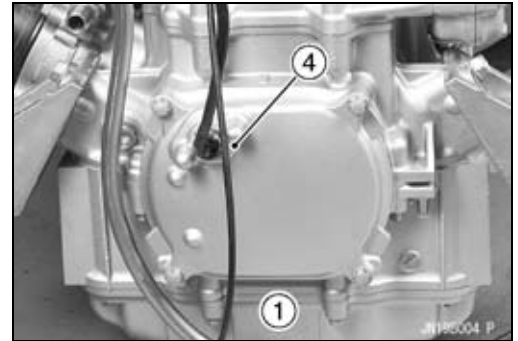
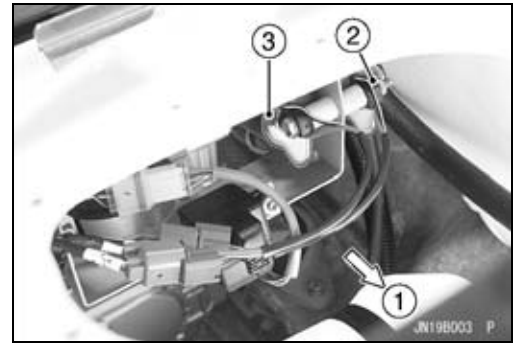
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14-2 ELECTRICAL SYSTEM

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Parts Location

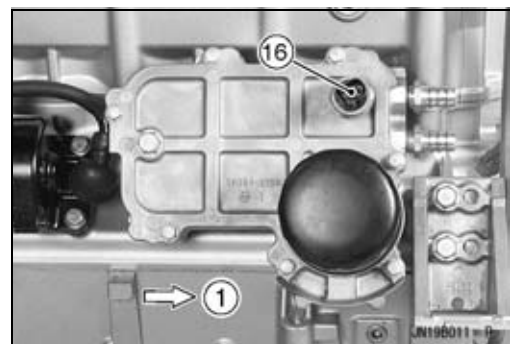
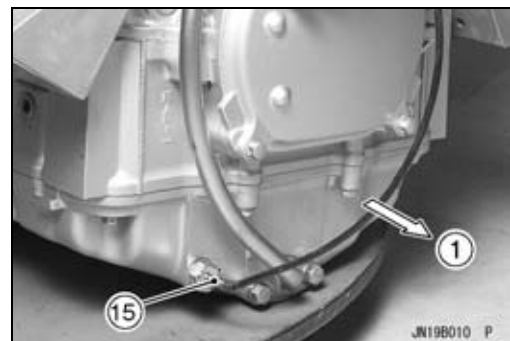
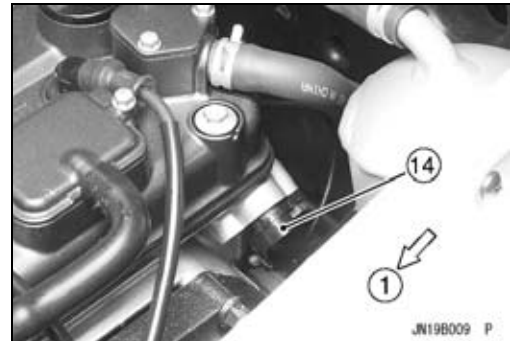
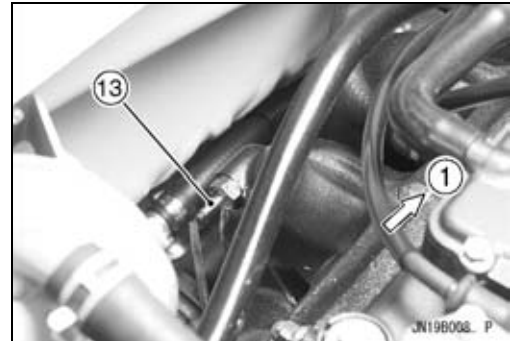
1. Bow
2. Ignition Coil #2, #3
3. Ignition Coil #1, #4
4. Crankshaft Sensor
5. Magneto
6. Starter Motor
7. Fuse Case
8. Regulator/Rectifier
9. ECU (Electronic Control Unit)
10. Starter Relay
11. Battery
12. Relay Assembly (Main Relay/Fuel Pump Relay)



14-4 ELECTRICAL SYSTEM

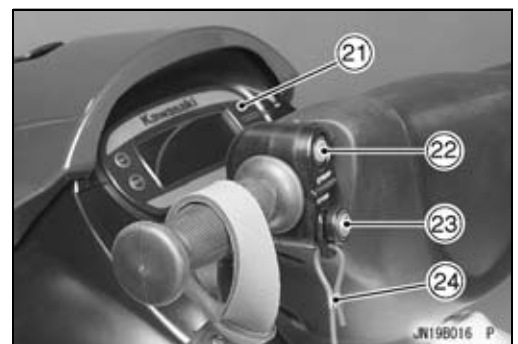
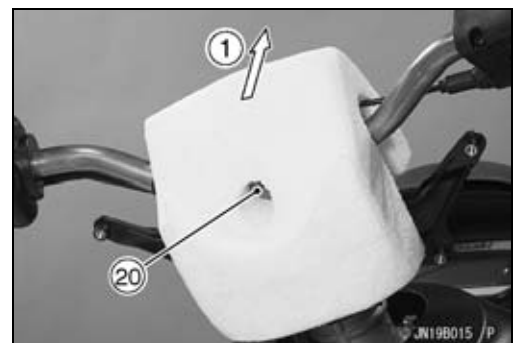
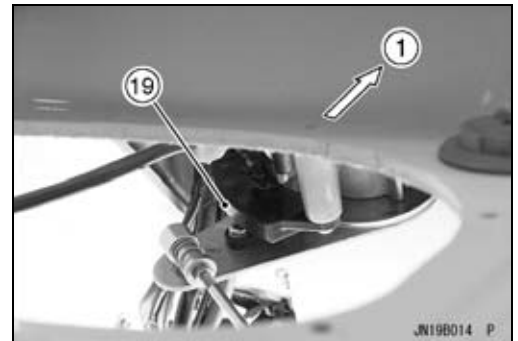
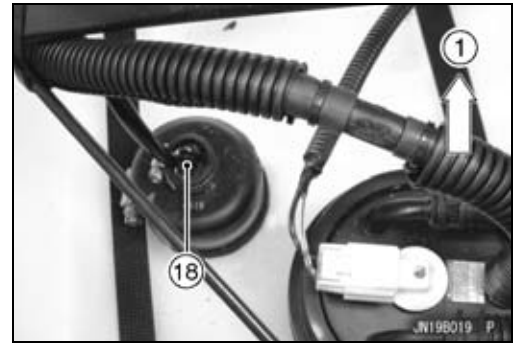
Parts Location

- 13. Water Temperature Sensor
- 14. Camshaft Position Sensor
- 15. Oil Temperature Sensor
- 16. Oil Pressure Switch
- 17. Speed Sensor



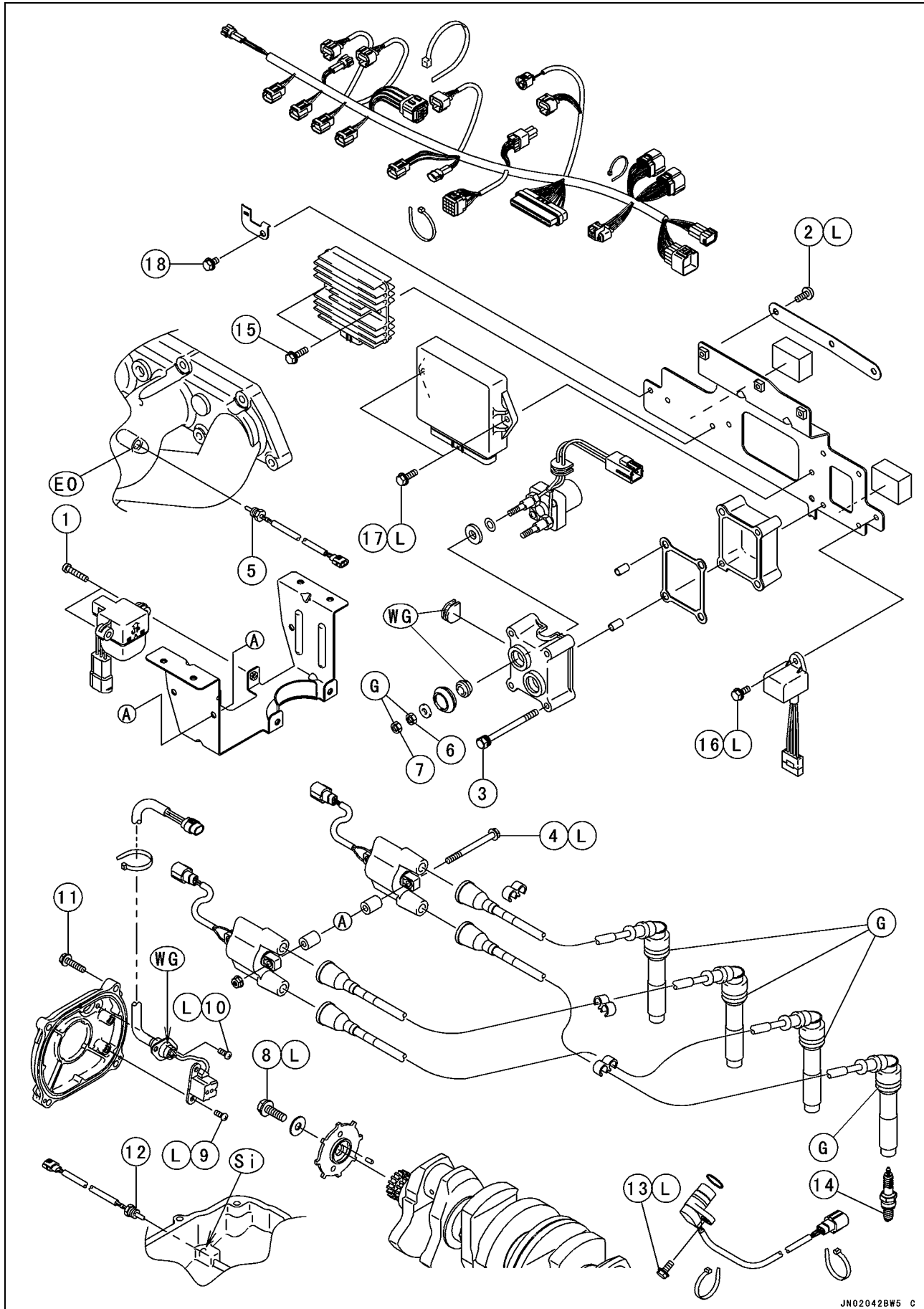
Parts Location

- 18. Fuel Level Sensor
- 19. Steering Position Sensor
- 20. Buzzer
- 21. Multifunction Meter
- 22. Starter Switch
- 23. Engine Stop Switch
- 24. Lanyard Key (Tether Code)
- 25. Ignition Switch



14-6 ELECTRICAL SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Vehicle-down Sensor Mounting Screws	1.5	0.15	13 in·lb	
2	Electrical Parts Bracket Screws	4.9	0.50	43 in·lb	L
3	Starter Relay Case Bolts	7.8	0.80	69 in·lb	
4	Ignition Coil Mounting Bolts	8.8	0.90	78 in·lb	L
5	Water Temperature Sensor	15	1.5	11	see text
6	Starter Relay Mounting Nuts	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
7	Starter Cable Mounting Nuts	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
8	Timing Rotor Bolt	20	2.0	14	L
9	Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
10	Rubber Grommet Holder Screws	4.4	0.45	39 in·lb	L
11	Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
12	Oil Temperature Sensor	15	1.5	11	see text
13	Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
14	Spark Plugs	13	1.3	113 in·lb	
15	Regulator/Rectifier Bolts	7.8	0.80	69 in·lb	
16	Relay Assembly Bolts	2.5	0.25	22 in·lb	L
17	ECU Mounting Bolts	8.8	0.90	78 in·lb	L
18	Main Fuse Mounting Bracket Bolt	7.8	0.80	69 in·lb	

EO: Fill the hollow of the exhaust manifold with engine oil (10W-30).

G: Apply grease.

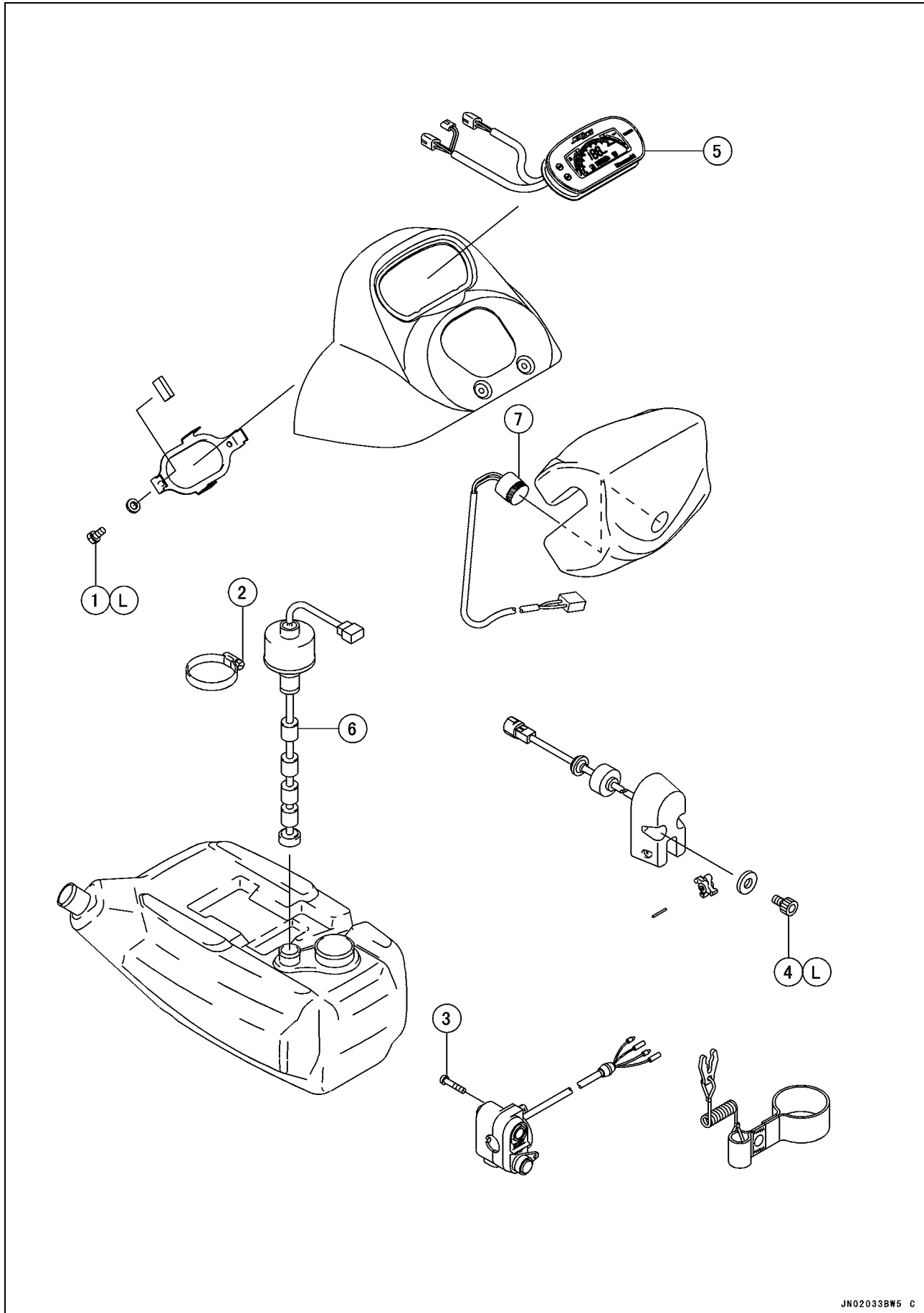
L: Apply a non-permanent locking agent.

Si: Fill the hollow of the oil pan with the specified silicone grease (Kawasaki Bond: 92137-1002).

WG: Apply water resistant grease.

14-8 ELECTRICAL SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Multifunction Meter Mounting Bolts	3.9	0.40	35 in·lb	L
2	Fuel Level Sensor Clamp Screw	2.9	0.30	26 in·lb	
3	Start/stop Switch Case Mounting Screw	3.9	0.40	35 in·lb	
4	Speed Sensor Mounting Bolts	3.9	0.40	35 in·lb	L

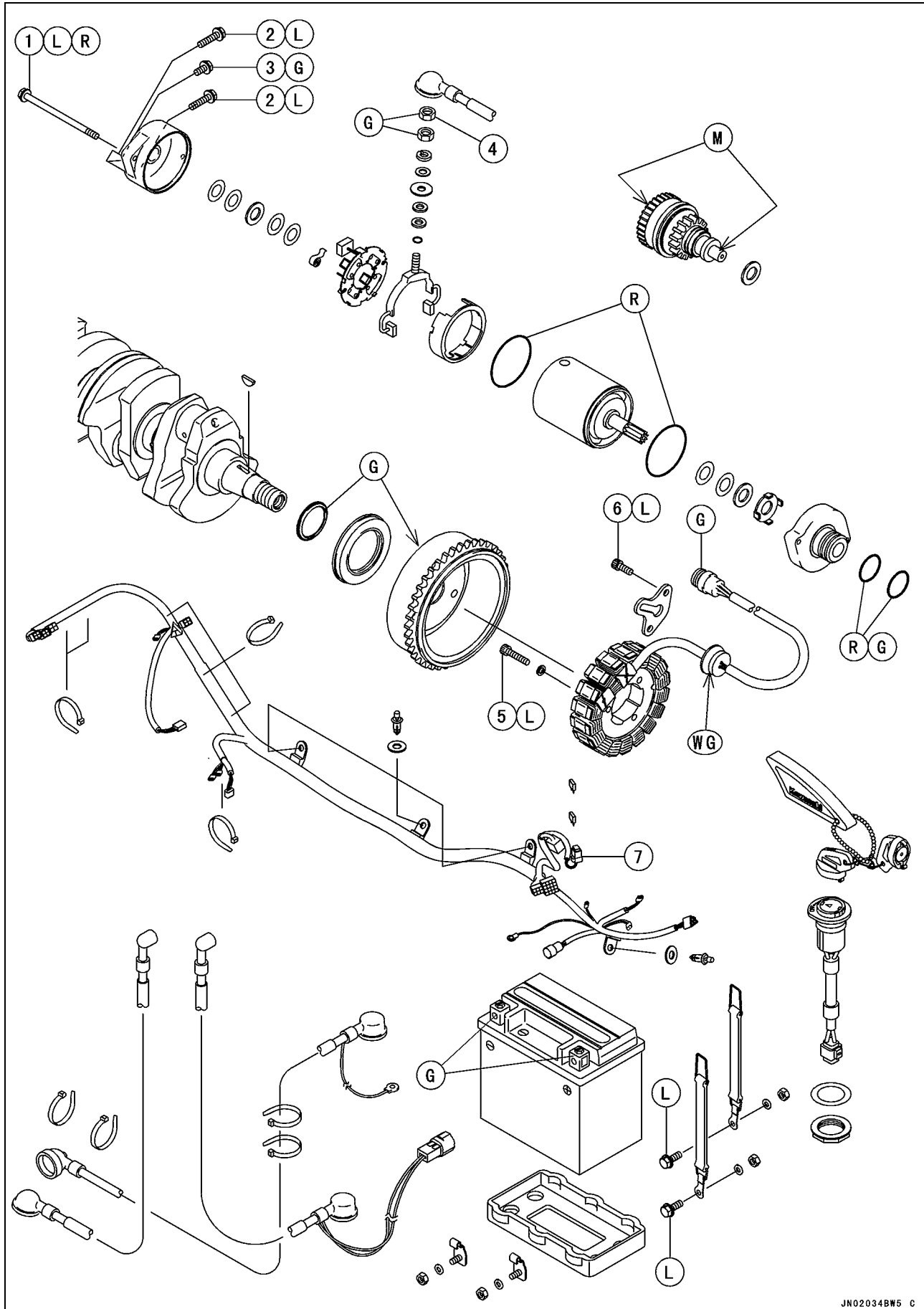
5. Multifunction Meter

6. Fuel Level Sensor

7. Buzzer

14-10 ELECTRICAL SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Starter Motor Through Bolts	6.4	0.65	56 in·lb	L, R
2	Starter Motor Mounting Bolts	8.8	0.90	78 in·lb	L
3	Starter Motor Ground Bolt	8.8	0.90	78 in·lb	
4	Starter Motor Terminal Nut	8.8	0.90	78 in·lb	
5	Stator Coil Bolts	12	1.2	104 in·lb	L
6	Grommet Holder Bolts	8.8	0.90	78 in·lb	L

7. Fuse

G: Apply grease.

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

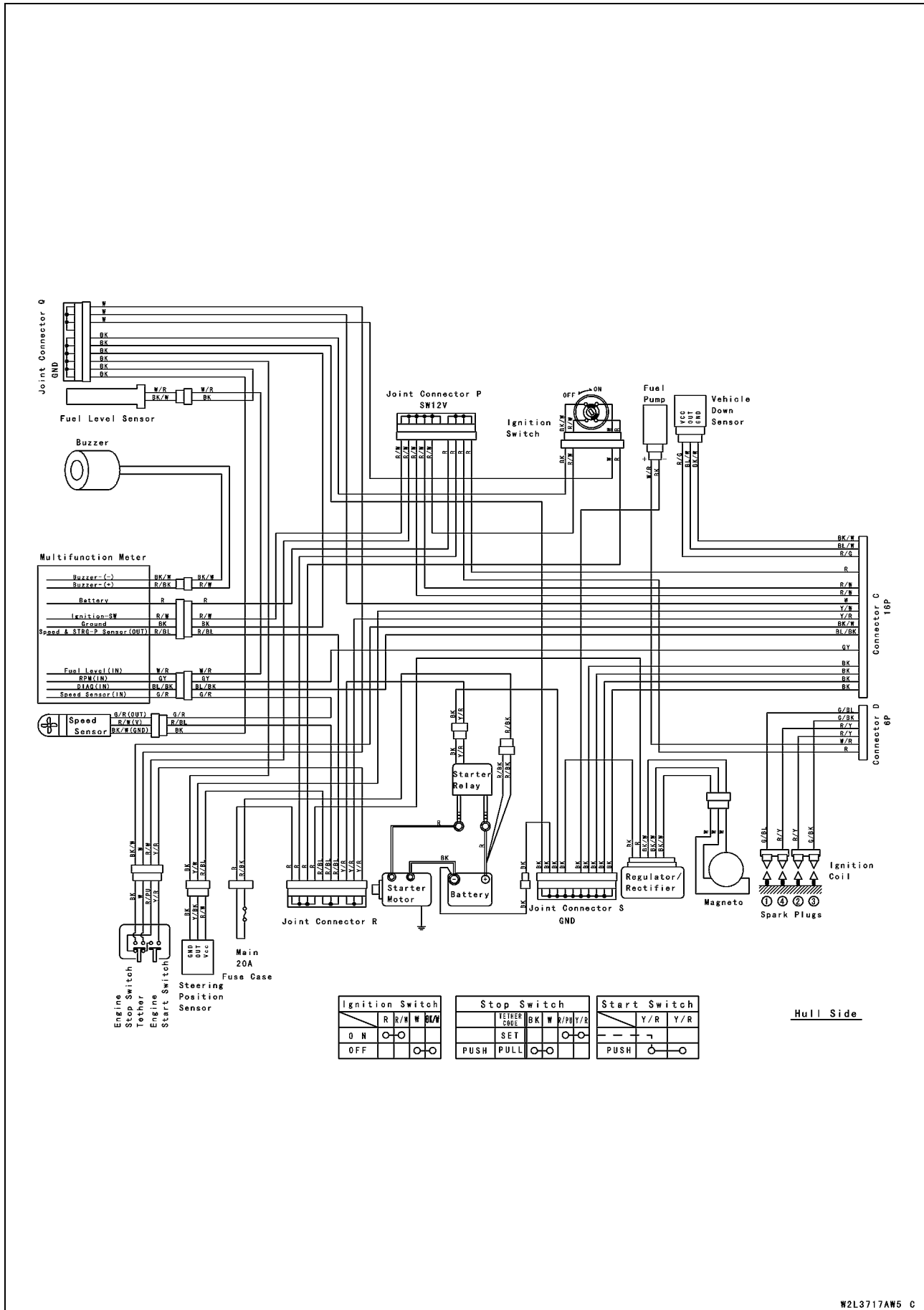
R: Replacement parts.

WG: Apply water resistant grease.

14-12 ELECTRICAL SYSTEM

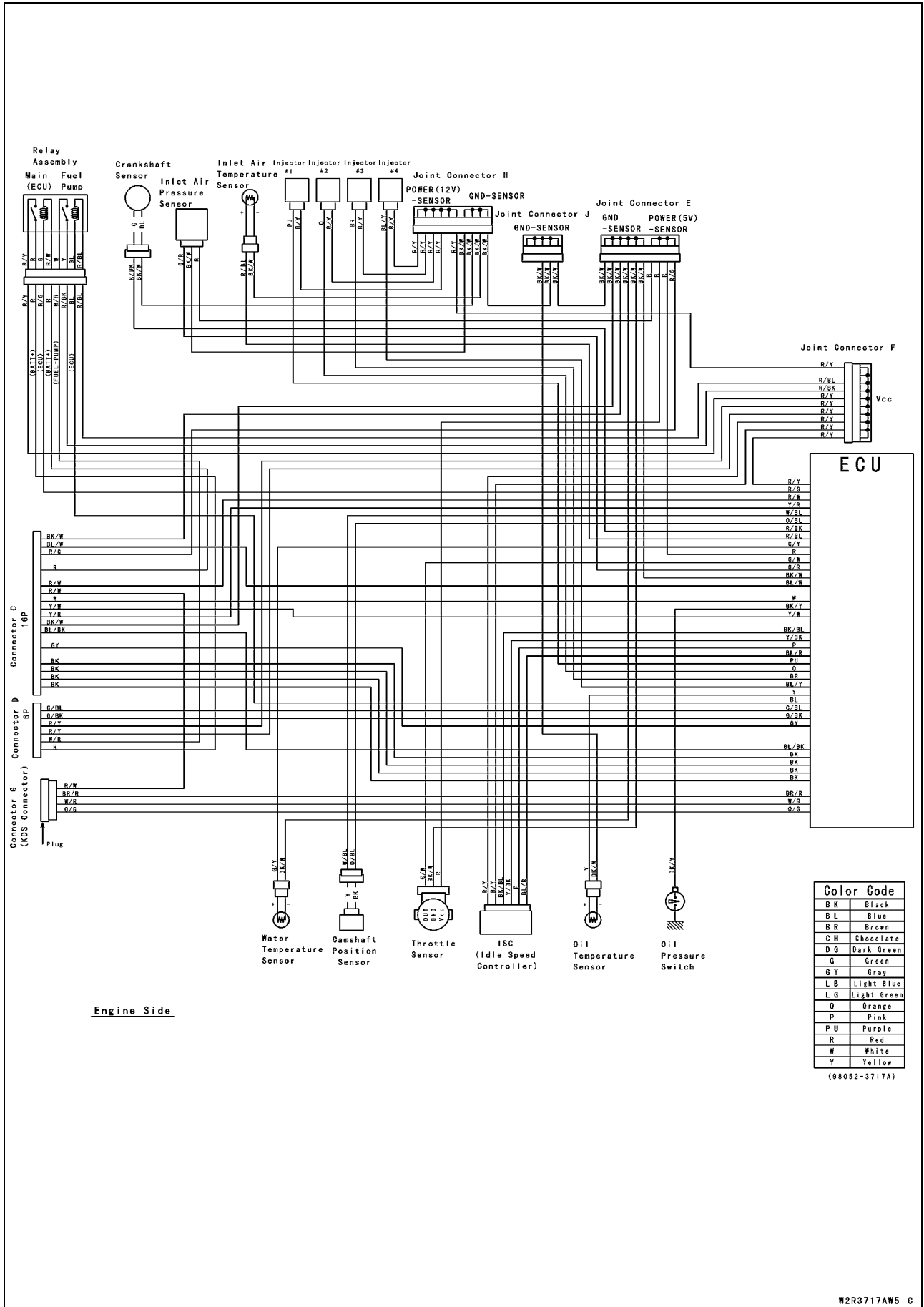
Wiring Diagram

JT1500-A1



Wiring Diagram

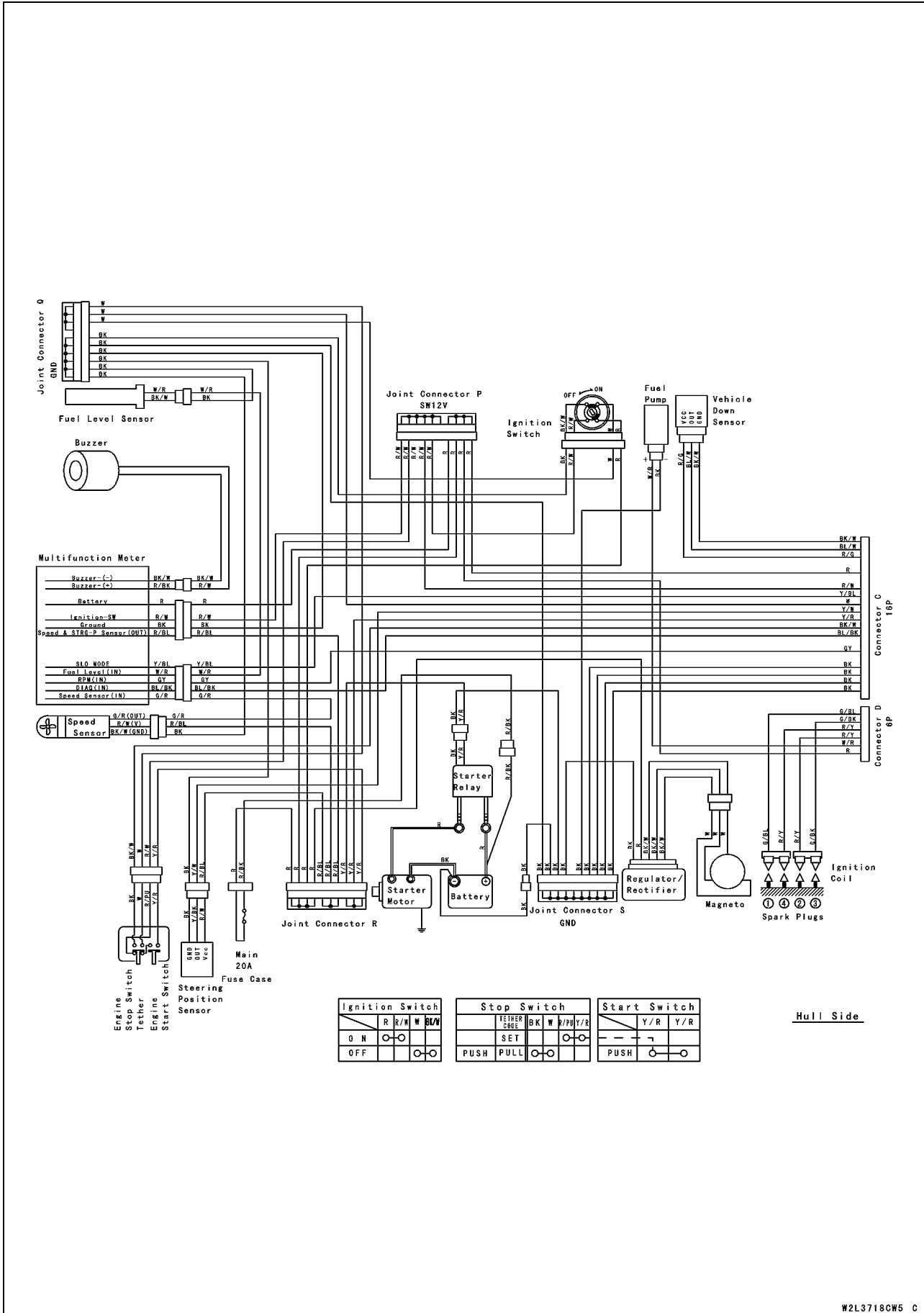
JT1500-A1



14-14 ELECTRICAL SYSTEM

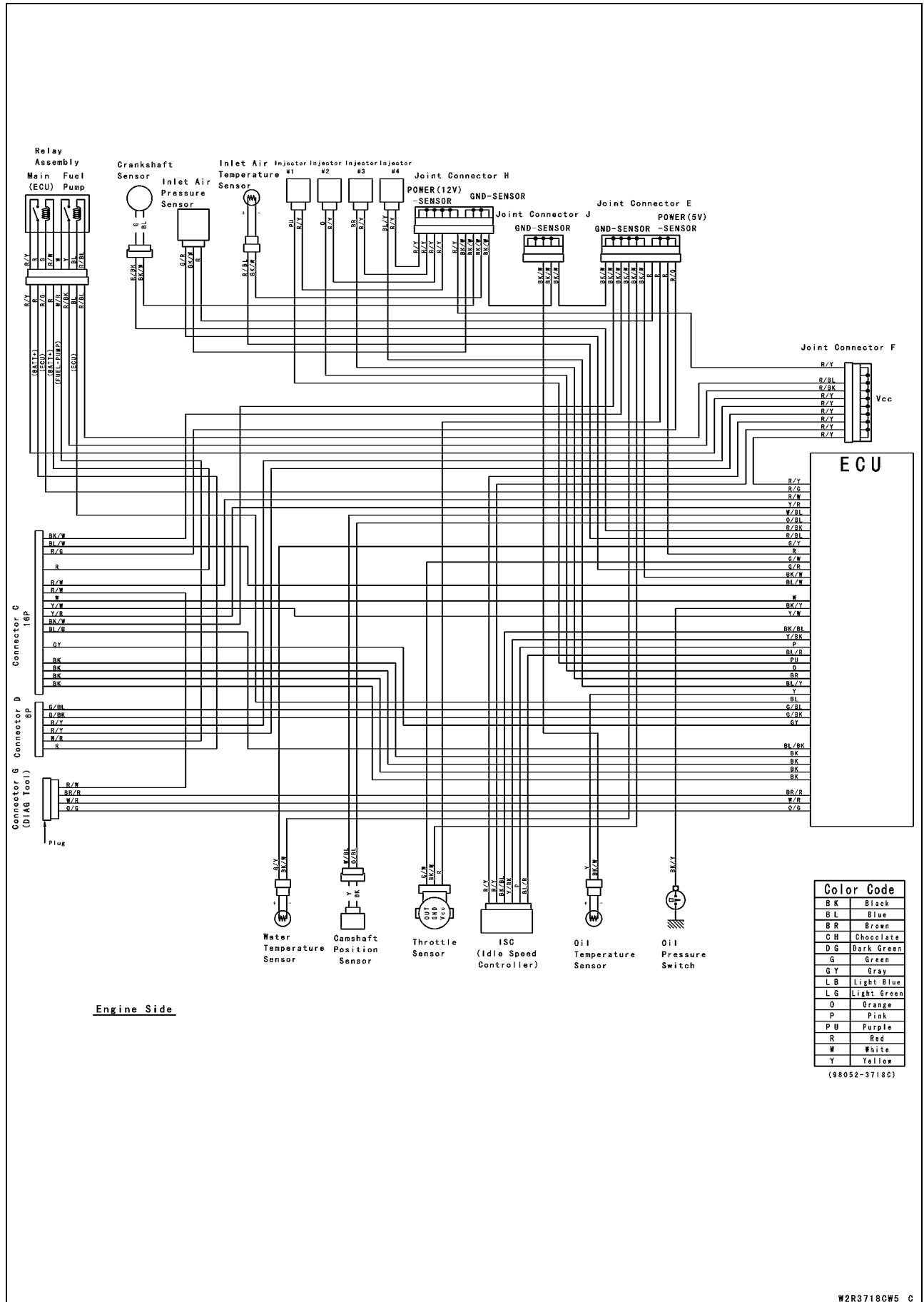
Wiring Diagram

JT1500-A2 ~



Wiring Diagram

JT1500-A2 ~



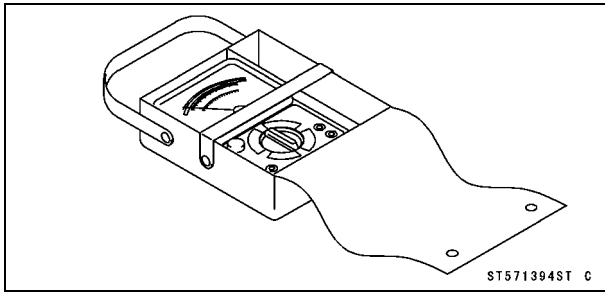
14-16 ELECTRICAL SYSTEM

Specifications

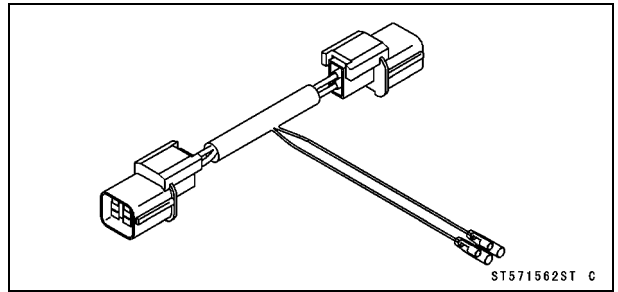
Item	Standard	Service Limit
Battery Type	12 V 18 Ah	— — —
Electric Starter System Starter Motor: Brush Length Commutator Diameter	12 mm (0.4724 in.) 28 mm (1.1024 in.)	6.5 mm (0.2559 in.) 27 mm (1.063 in.)
Charging System Regulator/rectifier Output Voltage Alternator Output Voltage Stator Coil Resistance	Battery Voltage 14 ~ 15 V 48 ~ 72 V 0.432 ~ 0.648 Ω	— — — — — — — — —
Ignition System Ignition Coil: Primary Winding Resistance Secondary Winding Resistance Spark Plug: Type Gap Crankshaft Sensor Resistance	1.53 ~ 2.07 Ω 12.50 ~ 16.91 k Ω NGK CR9EK 0.7 ~ 0.8 mm (0.0276 ~ 0.0315 in.) 408 ~ 612 Ω	— — — — — — — — — — — — — — —

Special Tools and Sealant

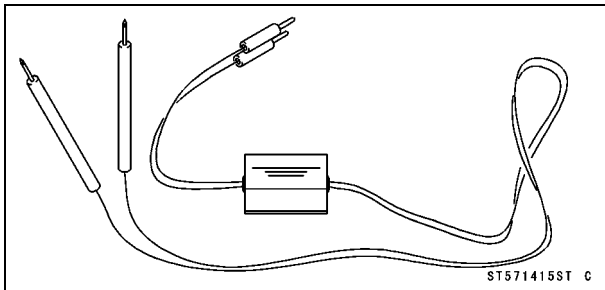
**Hand Tester:
57001-1394**



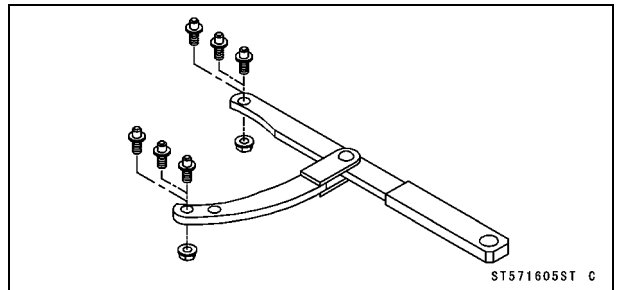
**Harness Adapter:
57001-1562**



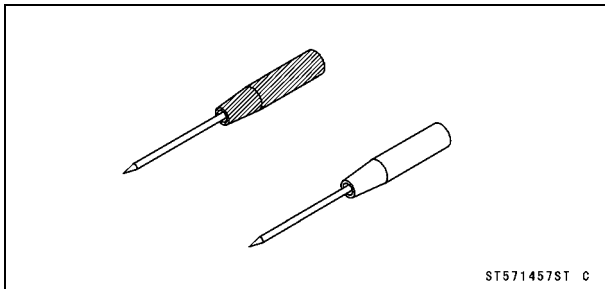
**Peak Voltage Adapter:
57001-1415**



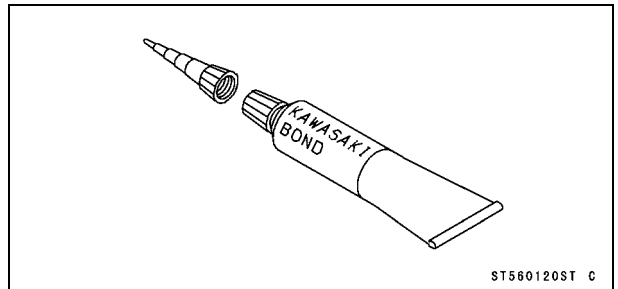
**Flywheel & Pulley Holder:
57001-1605**



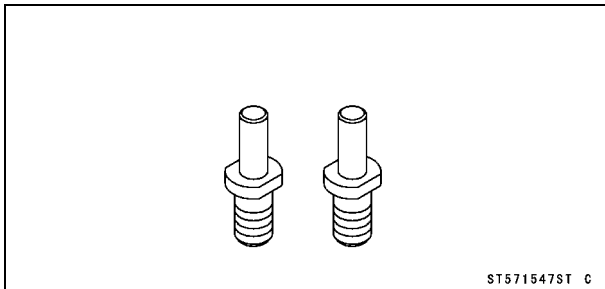
**Needle Adapter Set:
57001-1457**



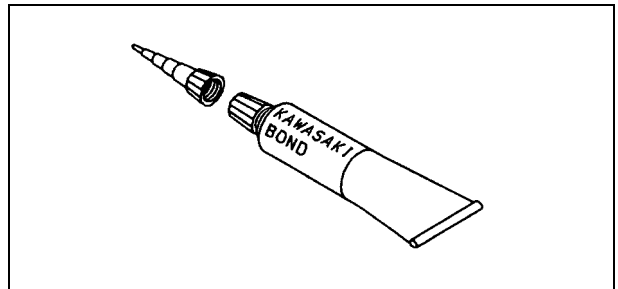
**Kawasaki Bond (Silicone Sealant):
56019-120**



**Holder Attachment:
57001-1547**



**Kawasaki Bond (Silicone Grease):
92137-1002**



14-18 ELECTRICAL SYSTEM

Precautions

There are a number of important precautions that should be followed servicing electrical systems.

- Do not reverse the battery cable connections. This will burn out the diodes on the electrical parts.
- Always check battery condition before condemning other parts of an electrical system. A fully charged battery is a must for conducting accurate electrical system tests.
- The electrical parts should never be struck sharply, as with a hammer, or allowed to fall on a hard surface. Such a shock to the parts can damage them.
- To prevent damage to electrical parts, do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running.
- Because of the large amount of current, never keep the starter button pushed when the starter motor will not turn over, or the current may burn out the starter motor windings.
- Do not use a meter illumination bulb rated for other than voltage or wattage specified in the wiring diagram, as the meter or gauge panel could be warped by excessive heat radiated from the bulb.
- Take care not to short the leads that are directly connected to the battery positive (+) terminal to the chassis ground.
- Troubles may involve one or in some cases all items.

Never replace a defective part without determining what CAUSED the failure. If the failure was caused by some other item or items, they must be repaired or replaced, or the new replacement will soon fail again

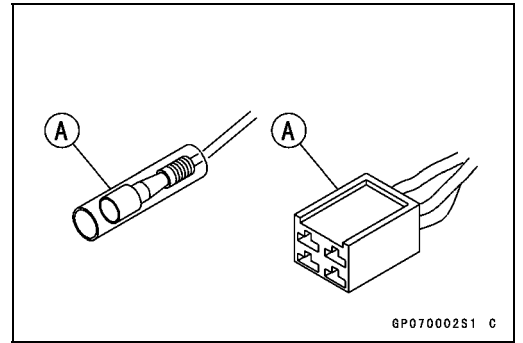
- Make sure all connectors in the circuit are clean and tight, and examine leads for signs of burning, fraying, etc. Poor leads and bad connections will affect electrical system operation.
- Measure coil and winding resistance when the part is cold (at room temperature).

Color Codes

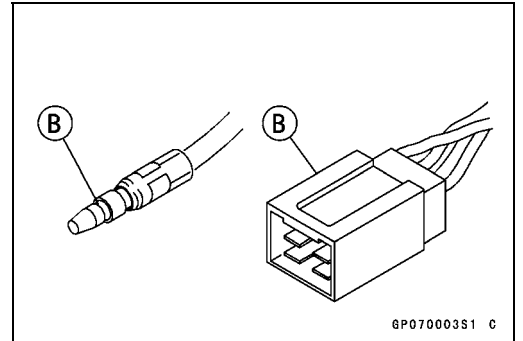
BK: Black	LG: Light Green
BL: Blue	O: Orange
BR: Brown	P: Pink
CH: Chocolate	PU: Purple
DG: Dark Green	R: Red
G: Green	W: White
GY: Gray	Y: Yellow
LB: Light Blue	

Precautions

○Electrical Connectors
Female Connectors [A]



Male Connectors [B]



14-20 ELECTRICAL SYSTEM

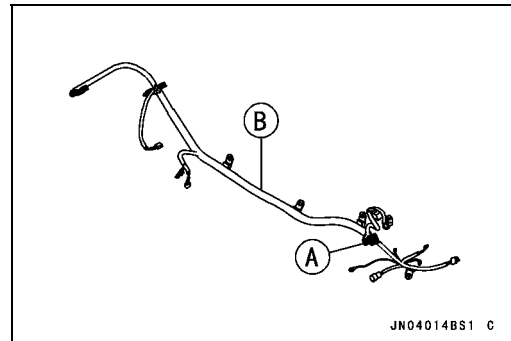
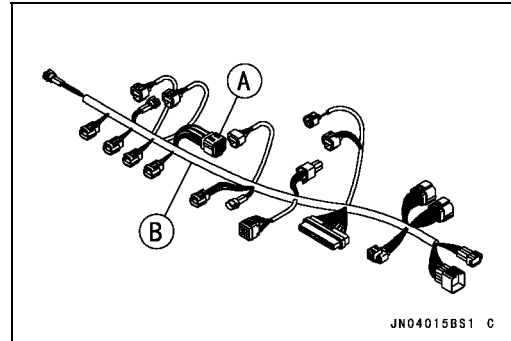
Electrical Wiring

Wiring Inspection

- Visually inspect the wiring for signs of burning, fraying, etc.
- ★ If any wiring is poor, replace the damaged wiring.
- Pull each connector [A] apart and inspect it for corrosion, dirt, and damage.
- ★ If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it.
- Check the wiring for continuity.
- Use the wiring diagram to find the ends of the lead which is suspected of being a problem.
- Connect the hand tester between the ends of the leads.

Special Tool - Hand Tester: 57001-1394

- Set the tester to the $\times 1 \Omega$ range, and read the tester.
- ★ If the tester does not read 0Ω , the lead is defective. Replace the lead or the wiring harness [B] if necessary.



Battery

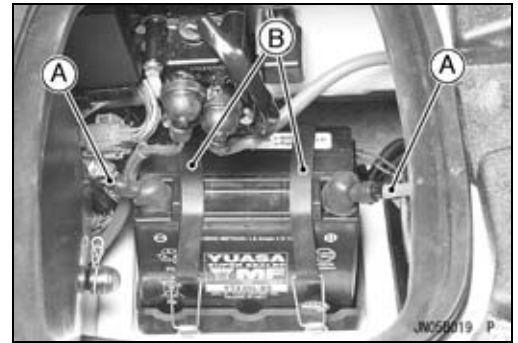
Removal

- Disconnect the battery cables [A].

⚠ WARNING

To prevent possible personal injury and damage to electrical components, always disconnect the grounded cable first.

- Unhook the battery straps [B].
- Carefully lift the battery from the engine compartment.

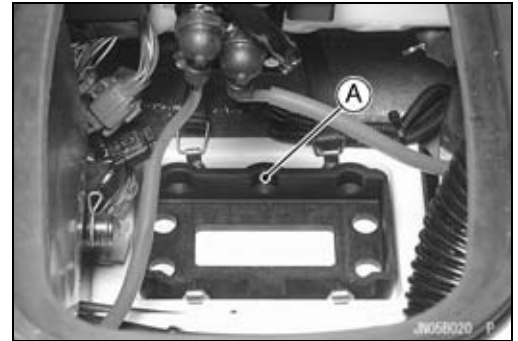


Installation

- Be sure the battery damper [A] is in position in the battery compartment.
- Hook the battery straps.
- Connect the battery cables, positive first.
- After attaching both cables, coat the terminals and cable ends with grease to prevent corrosion.
- Slide the protective boot over each terminal.

⚠ WARNING

Loose battery cables can create sparks which can cause a fire or explosion resulting in injury or death. Make sure the battery terminal screws are tightened securely and the covers are installed over the terminals.



CAUTION

Do not reverse the battery connections.

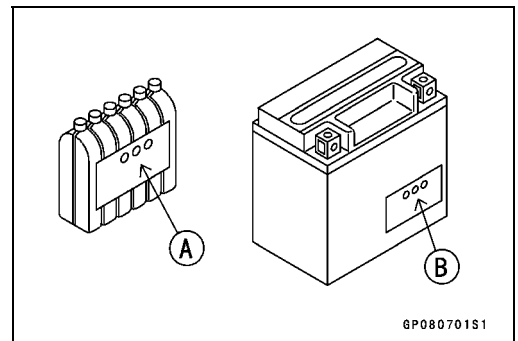
Electrolyte Filling

- Make sure that the model name [A] of the electrolyte container matches the model name [B] of the battery. These names must be the same.

Battery Model Name for JT1500-A1: YTX20L-BS

CAUTION

Be sure to use the electrolyte container with the same model name as the battery since the electrolyte volume and specific gravity vary with the battery type. This is to prevent overfilling of the electrolyte, shorting the battery life, and deterioration of the battery performance.



14-22 ELECTRICAL SYSTEM

Battery

- Check to see that there is no peeling, tears or holes in the seal sheet on the top of the battery.
- Place the battery on a level surface.
- Remove the seal sheet [A].

CAUTION

Do not remove the seal sheet sealing the filler ports [B] until just before use.

NOTE

○A battery whose seal sheet has any peeling, tears, or holes, requires a refreshing charge (initial charge).

- Take the electrolyte container out of the vinyl bag.
- Detach the strip of cap [A] from the container.

NOTE

○Do not discard the strip of cap because it is used as the battery plugs later.

○Do not peel back or pierce the seals [B] on the container.

- Place the electrolyte container upside down aligning the six seals with the six battery filler ports.
- Push the container down strongly enough to break the seals. Now the electrolyte should start to flow into the battery.

NOTE

○Do not tilt the container as the electrolyte flow may be interrupted.

- Check the electrolyte flow.
- ★If no air bubbles [A] are coming up from the filler ports, or if the container cells have not emptied completely, tap the container [B] a few times.
- Keep the container in place for **20** minutes or more. Don't remove the container from the battery until it's empty, the battery requires all the electrolyte from the container for proper operation.

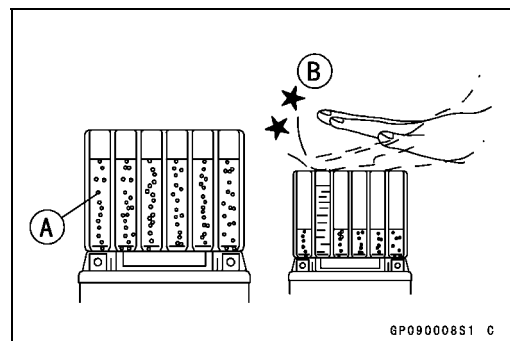
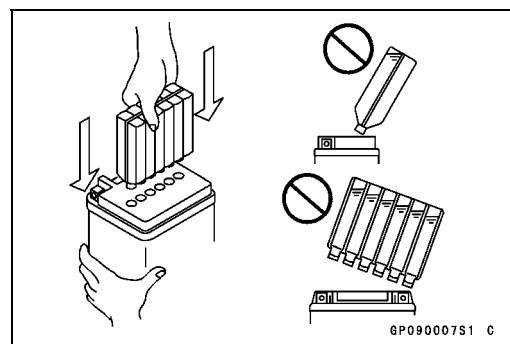
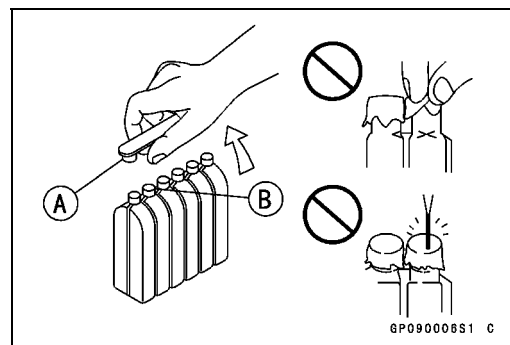
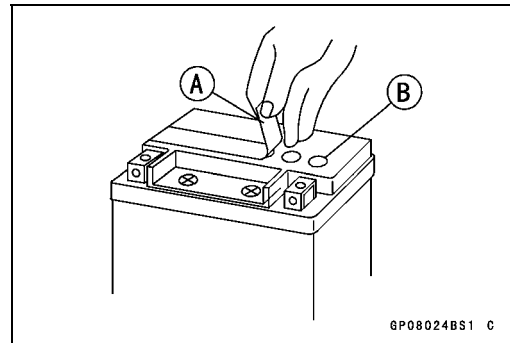
CAUTION

Removal of the container before it is completely empty can shorten the service life of the battery. Do not remove the electrolyte container until it is completely empty and 20 minutes have elapsed.

- Gently remove the container from the battery.
- Let the battery sit for **60** minutes prior to charging to allow the electrolyte to permeate into the plates for optimum performance.

NOTE

○Charging the battery immediately after filling can shorten service life. Let the battery sit for at least **60** minutes after filling.



Battery

Initial Charge

- Place the strip [A] of caps loosely over the filler ports.
- Newly activated sealed batteries require an initial charge.

Standard Charge 1.8 A × 5 ~ 10 hours

- ★ If using a recommended battery charger, follow the charger's instructions for newly activated sealed battery.

Kawasaki-recommended chargers

Optimate III

Yuasa 1.5 Amp Automatic Charger

Battery Mate 150-9

- ★ If the above chargers are not available, use equivalent one.

NOTE

○ Charging rates will vary depending on how long the battery has been stored, temperature, and the type of charger used. Let battery sit 30 minutes after initial charge, then check voltage using a voltmeter. If it is not at least 12.6 volts, repeat charging cycle.

- After charging is completed, press down firmly with both hands to seat the strip of caps [A] into the battery (don't pound or hammer). When properly installed, the strip of the caps will be level with the top of the battery.

CAUTION

Once the strip of the caps [A] is installed onto the battery, never remove the caps, nor add water or electrolyte to the battery.

NOTE

○ To ensure maximum battery life and customer satisfaction, it is recommended the battery be load tested at three times its amp-hour rating for 15 seconds. Re-check voltage and if less than 12.6 volts repeat the charging cycle and load test. If still below 12.6 volts the battery is defective.

Precautions

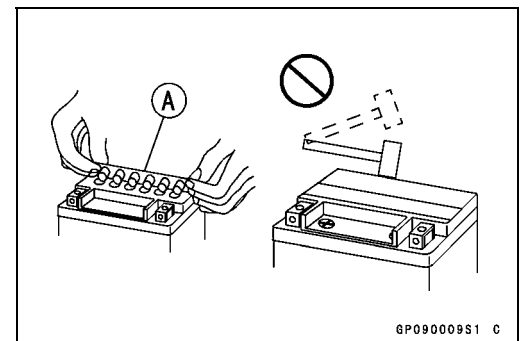
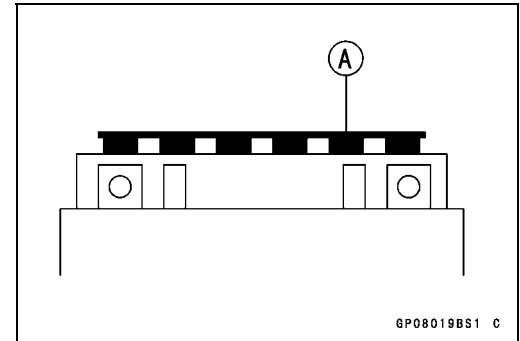
- 1) No need of topping-up

No topping-up is necessary in this battery until it ends its life under normal use. Forcibly prying off the seal cap to add water is very dangerous. Never do that.

- 2) Refreshing charge

If an engine will not start, it indicates the battery has been discharged. Give refresh charge for 5 to 10 hours with charge current shown in the specification (see this chapter).

When a fast charge is inevitably required, do it following precisely the maximum charge current and time conditions indicated on the battery.



CAUTION

This battery is designed to sustain no unusual deterioration if refresh-charged according to the method specified above. However, the battery's performance may be reduced noticeably if charged under conditions other than given above. Never remove the seal cap during refresh charge.

If by chance an excessive amount of gas is generated due to overcharging, the relief valve releases the gas to keep the battery normal.

14-24 ELECTRICAL SYSTEM

Battery

- 3) When you do not use the watercraft for months:
Give a refresh charge before you store the watercraft and store it with the negative lead removed. Give a refresh charge **once a month** during storage.
- 4) Battery life:
If the battery will not start the engine even after several refresh charges, the battery has exceeded its useful life. Replace it (Provided, however, the watercraft's starting system has no problem).

⚠ WARNING

Keep the battery away from sparks and open flames during charging, since the battery gives off an explosive gas mixture of hydrogen and oxygen. When using a battery charger, connect the battery to the charger before turning on the charger.

This procedure prevents sparks at the battery terminals which could ignite any battery gases.

No fire should be drawn near the battery, or no terminals should have the tightening loosened.

The electrolyte contains sulfuric acid. Be careful not to have it touch your skin or eyes. If touched, wash it off with liberal amount of water. Get medical attention if severe.

Interchange

A sealed battery can fully display its performance only when combined with a proper watercraft electric system. Therefore, replace a sealed battery only on watercraft which was originally equipped with a sealed battery.

Be careful, if a sealed battery is installed on watercraft which had an ordinary battery as original equipment, the sealed battery's life will be shortened.

Charging Condition Inspection

- Refer to Battery Charging Condition Inspection in the Periodic Maintenance chapter.

Refreshing Charge

- Remove the battery [A] (see Battery Removal).
- Refresh-charge by following method according to the battery terminal voltage.

⚠ WARNING

This battery is sealed type. Never remove the strip of cap [B] even at charging. Never add water. Charge with current and time as stated below.

Terminal Voltage: 11.5 ~ less than 12.6 V

Standard Charge: 1.8 A × 5 ~ 10 h (see following chart)

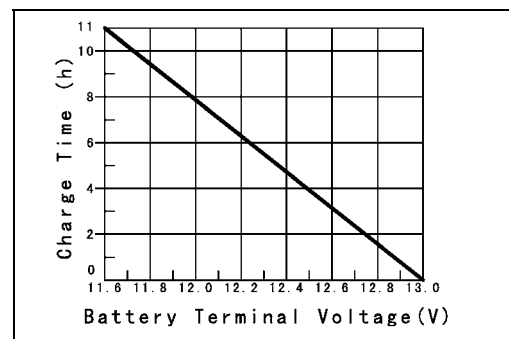
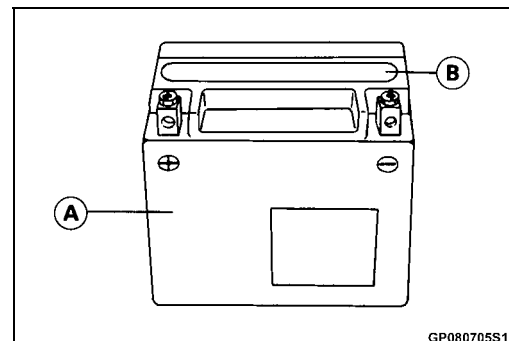
Quick Charge: 9.0 A × 1.0 h

CAUTION

If possible, do not quick charge. If the quick charge is done due to unavoidable circumstances, do standard charge later on.

Terminal Voltage: less than 11.5 V

Charging Method: 1.8 A × 20 h



Battery

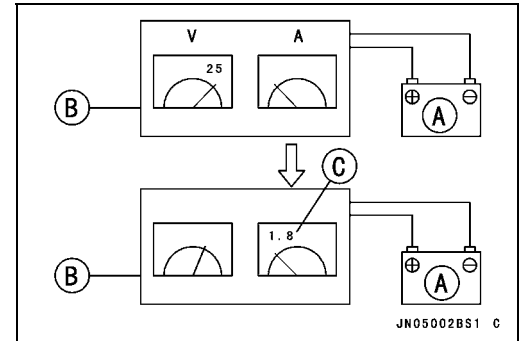
NOTE

- Increase the charging voltage to a maximum voltage of 25 V if the battery will not accept current initially. Charge for no more than five minutes at the increased voltage then check if the battery is drawing current.
- If the battery will accept current, decrease the voltage and charge by the standard charging method described on the battery case. If the battery will not accept current after 5 minutes, replace the battery.

Battery [A]

Battery Charger [B]

Standard Value [C]



- Determine battery condition after refreshing charge.
- Determine the condition of the battery 30 minutes after completion of the charge by measuring the terminal voltage according to the table below.

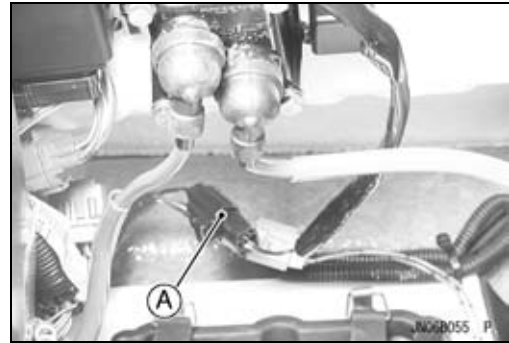
Criteria	Judgement
12.6 V or more	Good
12.0 ~ less than 12.6 V	Charge insufficient → Recharge
less than 12.0 V	Unserviceable → Replace

14-26 ELECTRICAL SYSTEM

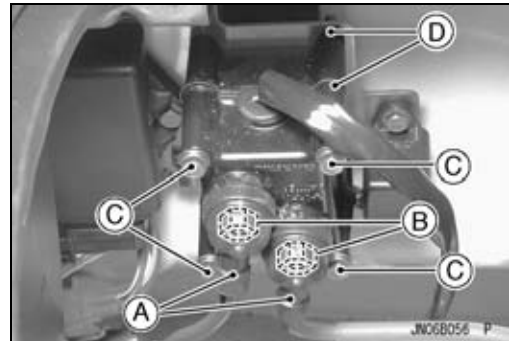
Electric Starter System

Starter Relay Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Rear Storage Pocket (see Hull/Engine Hood chapter)
 - Battery (see this chapter)
- Disconnect the negative battery cable from the battery terminal. (see Battery Removal).
- Disconnect the starter relay lead connector [A].



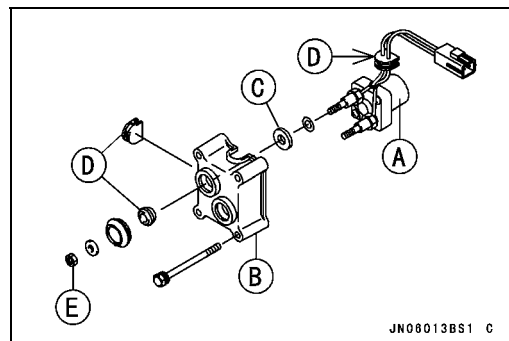
- Slide out the rubber caps [A].
- Remove the nuts [B] from the battery and starter terminals on the start relay switch.
- Remove the starter relay case bolts [C] and slide the starter relay switch from the relay case [D], being careful not to lose any of the insulating washers or grommets.



Starter Relay Installation

- Mount the starter relay switch [A] in the relay case [B].
- Coat the insulating washers [C] and grommets [D] with water resistant grease.
- Be certain all insulating washers and grommets are in position.
- Tighten the relay mounting nuts [E] securely.

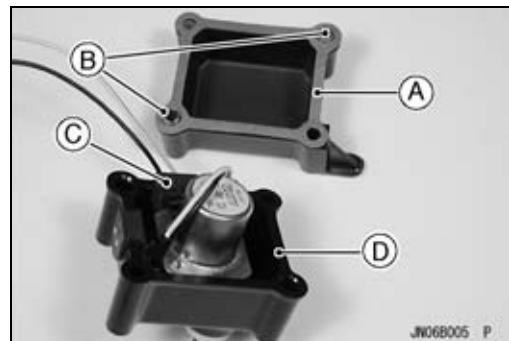
Torque - Starter Relay Mounting Nuts: 4 N·m (0.40 kgf·m, 35 in·lb)



- Replace the gasket [A] with a new one.
- Be sure the dowel pins [B] are in position.
- Be sure the grommet [C] is installed on the relay case [D].
- Be sure the battery cable is connected to the battery terminal having red mark.

Torque - Starter Relay Case Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

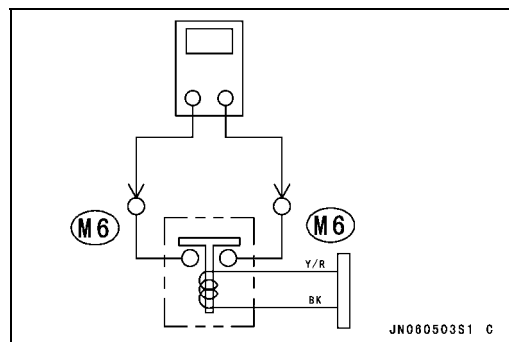
Starter Cable Mounting Nuts: 4 N·m (0.40 kgf·m, 35 in·lb)



Starter Relay Inspection

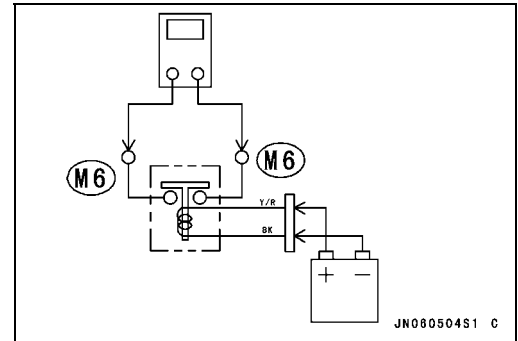
- Remove the starter relay (see Starter Relay Removal).
- Set hand tester to $R \times 1 \Omega$ range.
- Connect meter leads to starter relay as shown.
- ★ If resistance is less than infinite, the starter relay switch is not returning and must be replaced.

Special Tool - Hand Tester: 57001-1394



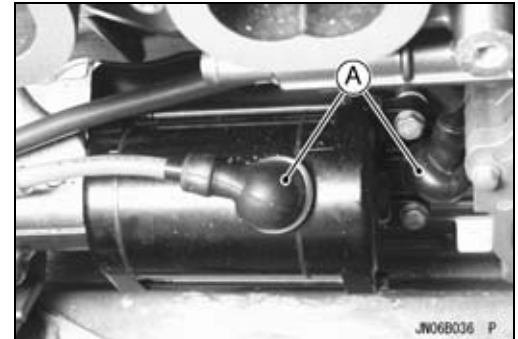
Electric Starter System

- Set ohmmeter to $R \times 1 \Omega$ range.
- Connect meter leads to starter relay as shown.
- Activate starter relay switch by connecting a 12 V battery as shown.
- ★ If the starter relay switch clicks and the ohmmeter indicates zero resistance, the starter relay switch is good.
- ★ If the meter indicates high or infinite (∞) resistance, the starter relay switch is defective and must be replaced.

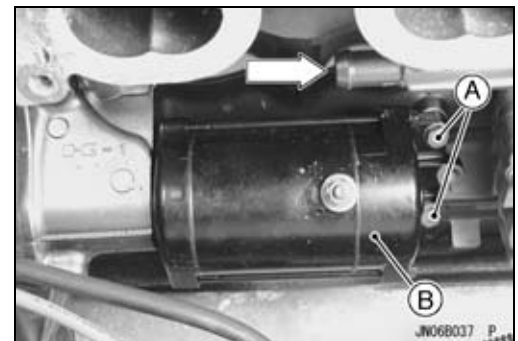


Starter Motor Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Inlet Manifold (see Fuel System chapter)
- Side out the rubber caps [A] and remove the terminal nuts.



- Remove the mounting bolts [A].
- Pull out the starter motor [B].

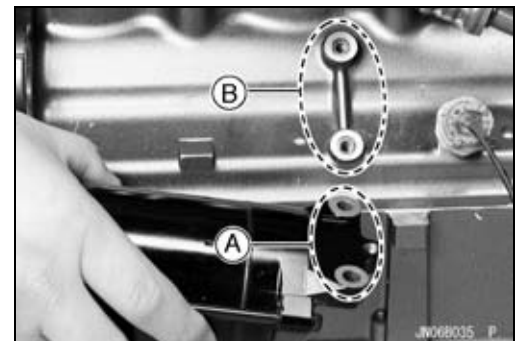


Starter Motor Installation

CAUTION

Do not tap the starter motor shaft or body. Tapping the shaft or body could damage the motor.

- When installing the starter motor, clean the starter motor legs [A] and crankcase [B] where the starter motor is grounded.



- Apply grease to the O-rings [A].
 - Install the starter motor and tighten the mounting bolts.
- Torque - Starter Motor Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)**

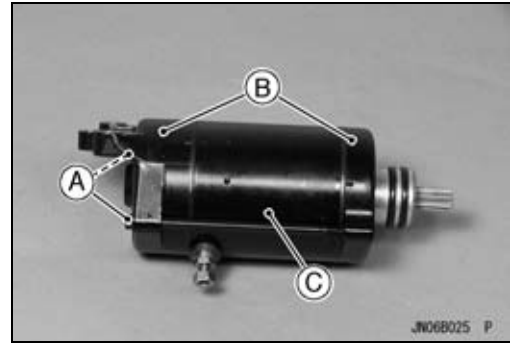


14-28 ELECTRICAL SYSTEM

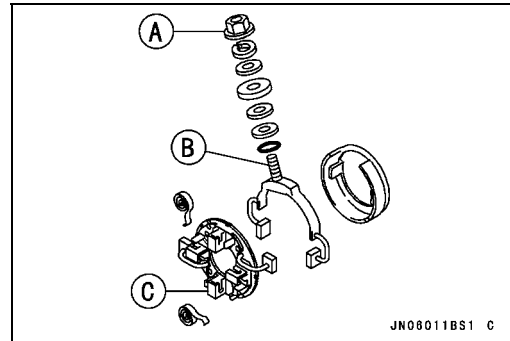
Electric Starter System

Starter Motor Disassembly

- Remove the starter motor (see Starter Relay Removal).
- Take off the starter motor through bolts [A] and remove both end covers [B] and pull the armature out of the yoke [C].

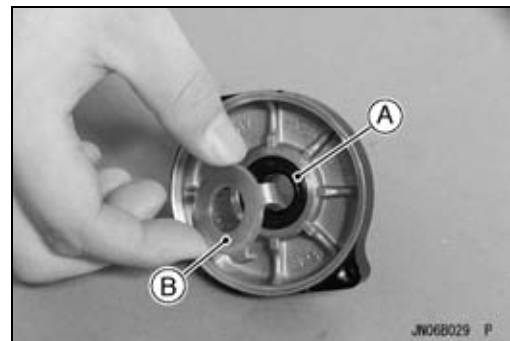


- Remove the terminal locknut [A] and terminal bolt [B], and then remove the brush with the brush plate [C] from the yoke.

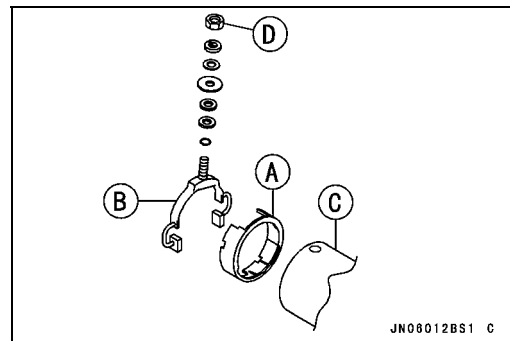


Starter Motor Assembly

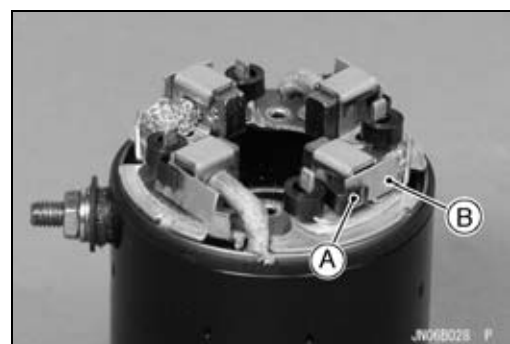
- Apply a thin coat of grease to the oil seal [A].
- Fit the toothed washer [B] into the end cover.



- Install the plate cover [A] and the positive brush assembly [B] in the yoke [C].
- Tighten the terminal nut [D] securely.

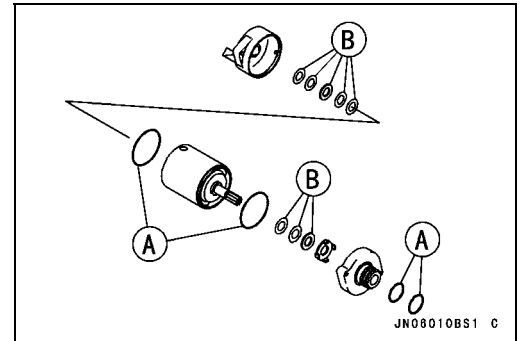


- Holding the spring ends [A] with suitable plates [B], put the armature among the brushes.

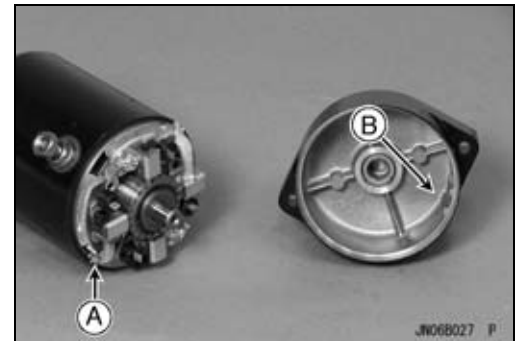


Electric Starter System

- Install the O-rings [A] and the washers [B] as shown.

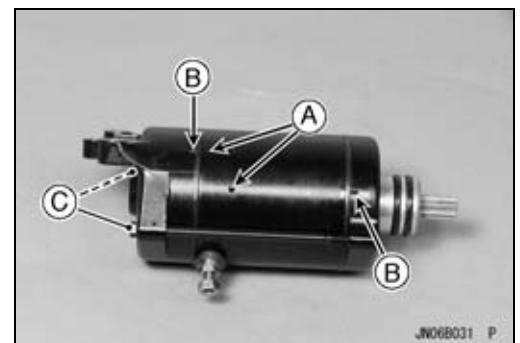


- Fit the tongue [A] on the brush plate into the end cover groove [B].



- Align the lines [A] on the yoke with the lines [B] on the both end covers.
- Replace the starter motor through bolts [C] with new ones.
- Tighten:

Torque - Starter Motor Through Bolts: 6.4 N·m (0.65 kgf·m, 56 in·lb)



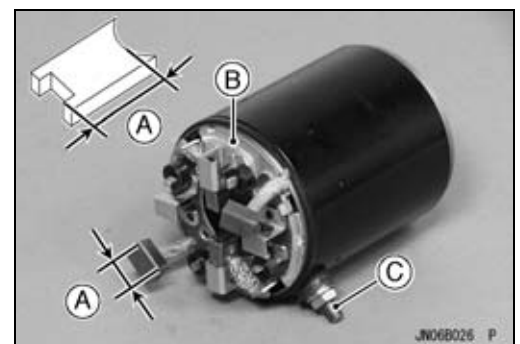
Brush Inspection

- Measure the length [A] of each brush.
- ★ If any is worn down to the service limit, replace the negative brush assembly [B] and the positive brush assembly [C].

Starter Motor Brush Length

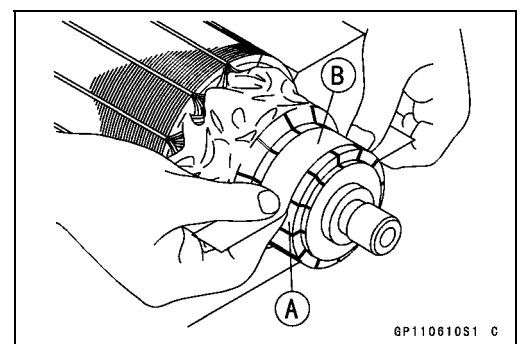
Standard: 12 mm (0.4724 in.)

Service Limit: 6.5 mm (0.2559 in.)



Commutator Cleaning and Inspection

- Smooth the commutator surface [A] if necessary with fine emery cloth [B], and clean out the grooves.



14-30 ELECTRICAL SYSTEM

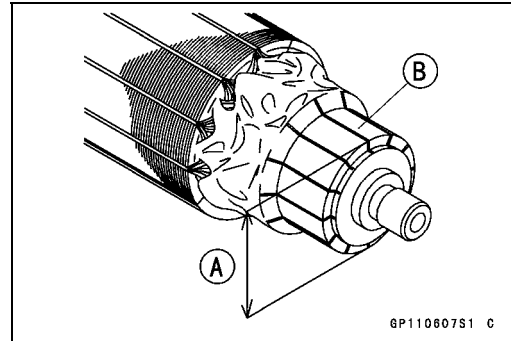
Electric Starter System

- Measure the diameter [A] of the commutator [B].
- ★ Replace the starter motor with a new one if the commutator diameter is less than the service limit.

Commutator Diameter

Standard: 28 mm (1.1024 in.)

Service Limit: 27 mm (1.063 in.)

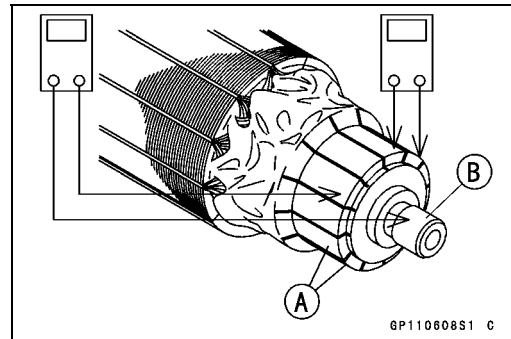


Armature Inspection

- Using the $\times 1 \Omega$ hand tester range, measure the resistance between any two commutator segments [A].

Special Tool - Hand Tester: 57001-1394

- ★ If there is a high resistance or no reading (∞) between any two segments, a winding is open and the starter motor must be replaced.
- Using the highest hand tester range, measure the resistance between the segments and the shaft [B].
- ★ If there is any reading at all, the armature has a short and the starter motor must be replaced.



NOTE

○ Even if the foregoing checks show the armature to be good, it may be defective in some manner not readily detectable within the hand tester. If all other starter motor and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the starter motor with a new one.

Brush Lead Inspection

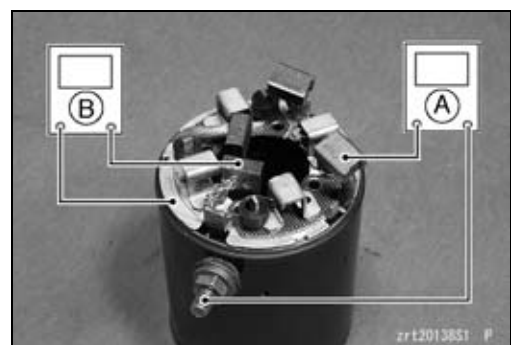
- Using the $\times 1 \Omega$ hand tester range, measure the resistance as shown.

[A] Terminal and Positive Brush

[B] Brush Plate and Negative Brush

Special Tool - Hand Tester: 57001-1394

- ★ If there is not close to zero ohms, the brush lead has an open. Replace the positive brush assembly and/or the negative brush assembly.



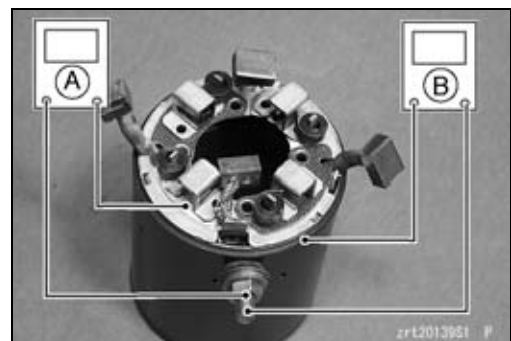
Brush Plate and Terminal Bolt Inspection

- Using the highest hand tester range, measure the resistance as shown.

[A] Terminal Bolt and Brush Plate

[B] Terminal Bolt and Yoke

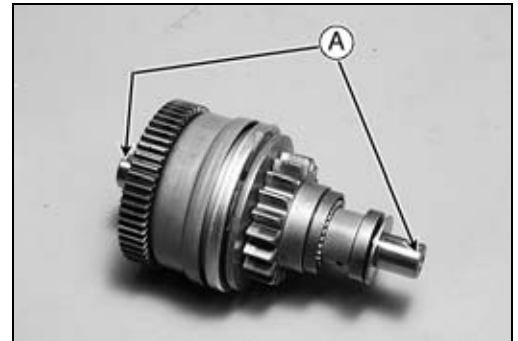
- ★ If there is any reading, the negative brush assembly and/or positive brush assembly have a short. Replace the negative and positive brush assemblies.



Electric Starter System

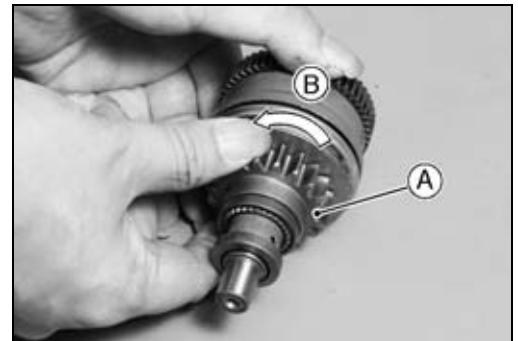
Reduction Gear Removal/Installation

- Before removing the reduction gear, remove the magneto flywheel (see Engine Bottom End chapter).
- When installing the reduction gear, apply a molybdenum disulfide grease [A] to both ends of its shaft.

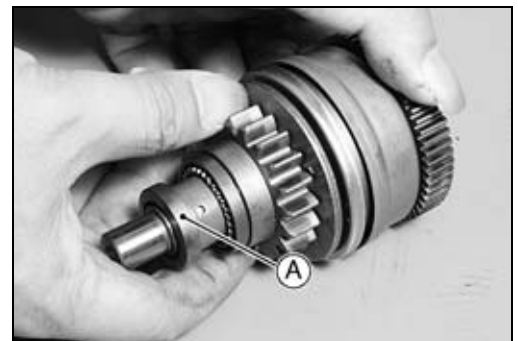


Reduction Gear Inspection

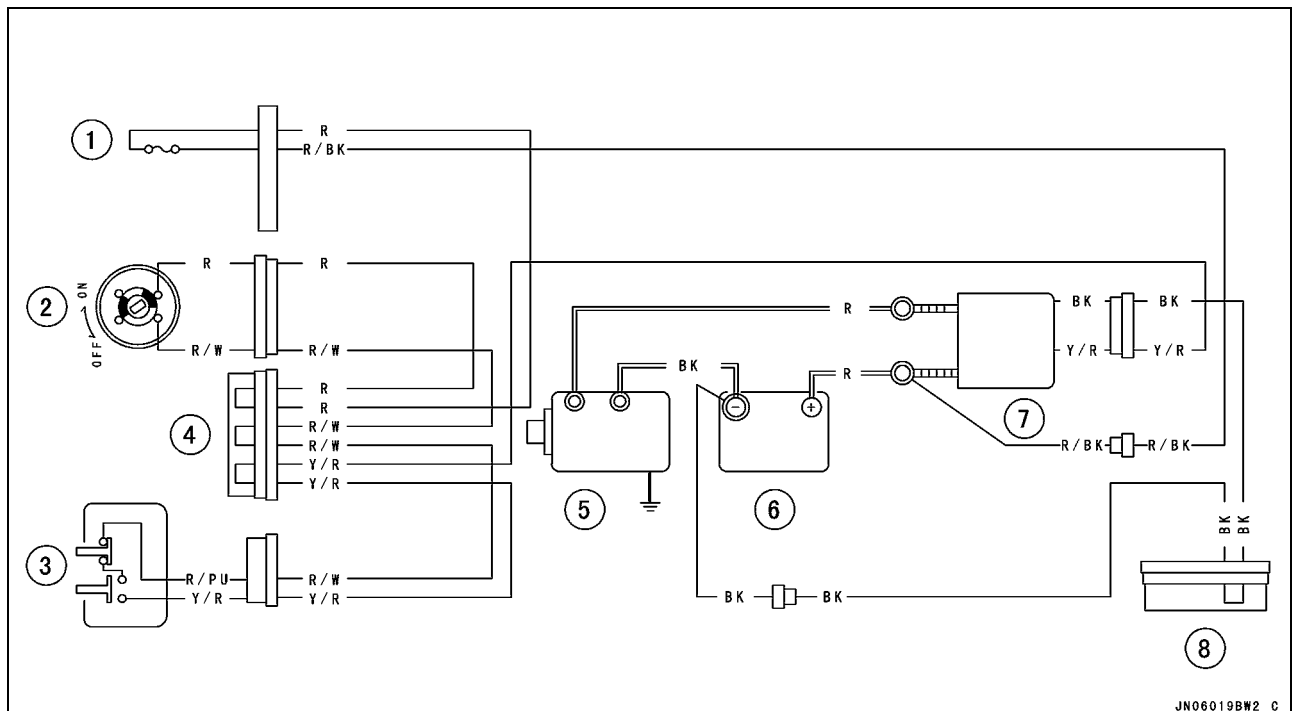
- Rotate the pinion gear [A] counterclockwise. The gear must be rotated freely [B].



- Rotate the pinion gear clockwise all the way. The pinion gear will be advanced along the reduction gear shaft, and stopped against the stopper [A].
- Release the pinion gear. The pinion gear must return to the initial position rapidly.
- ★ If the pinion gear does not function properly, replace it.



Electric Starter Circuit



1. Main Fuse 20 A
2. Ignition Switch

14-32 ELECTRICAL SYSTEM

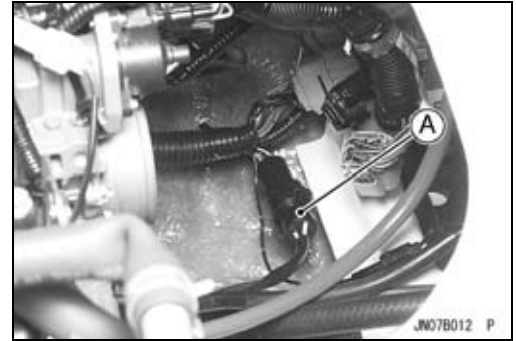
Electric Starter System

3. Engine Starter Switch
4. Joint Connector R
5. Starter Motor
6. Battery 12 V 18 Ah
7. Starter Relay
8. Joint Connector S
(Ground)

Charging System

Magneto Output Voltage

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Air Filter with Duct (see Fuel System chapter)
- Disconnect the 3-pin stator coil leads connector [A].



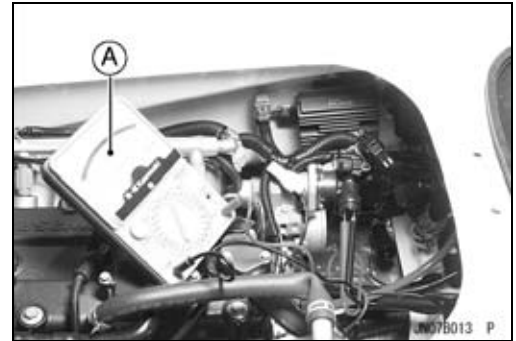
- With the hand tester [A] check the magneto output (in circuit) according to the following table with the engine running at approximately 3 000 rpm.

⚠ WARNING

To avoid electrical shock, do not perform this test with the watercraft in the water.

CAUTION

Do not run the engine over 15 seconds without cooling water.



Magneto Output Voltage

Meter Setting	Connections		Standard Value
	Meter (+) to	Meter (-) to	
250 V AC	White lead	White lead	48 ~ 72 V

- ★ If the magneto output voltage is correct, check the regulator according to the regulator test procedure.
- ★ If the magneto output voltage is low, check the stator coil resistance with a multimeter according to the following table.

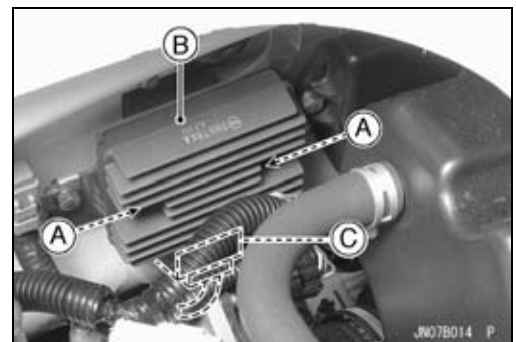
Stator Coil Resistance Test

Meter Setting	Connections		Standard Value
	Meter (+) to	Meter (-) to	
R × 1 Ω	White lead	White lead	0.432 ~ 0.648 Ω

- ★ If the coil has normal resistance, but the voltage check shows the charging system to be defective, then the permanent magnets in the flywheel have probably weakened, necessitating flywheel replacement.

Regulator/Rectifier Removal/Installation

- Remove the seat (see Hull/Engine Hood chapter).
- Unscrew the mounting bolts [A] and remove the regulator/rectifier [B].
- Disconnect the connector [C].



14-34 ELECTRICAL SYSTEM

Charging System

- Tighten:
 - Torque - Regulator/rectifier Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)
- When installing the bracket, apply a non-permanent locking agent to the bracket mounting screws and tighten them securely.

Regulator/Rectifier Inspection

- With the hand tester set to the R × 1 kΩ range, test the regulator/rectifier according the following table.

Special Tool - Hand Tester: 57001-1394

Regulator/Rectifier Inspection

Unit: kΩ

	Tester (+) Lead Connection					
	Terminal	+	~	~	~	-
(-)*	+	-	500 ~ ∞	500 ~ ∞	500 ~ ∞	500 ~ ∞
	~	2 ~ 20	-	500 ~ ∞	500 ~ ∞	500 ~ ∞
	~	2 ~ 20	500 ~ ∞	-	500 ~ ∞	500 ~ ∞
	~	2 ~ 20	500 ~ ∞	500 ~ ∞	-	500 ~ ∞
	-	2 ~ 40	2 ~ 20	2 ~ 20	2 ~ 20	-

(-)*: Tester (-) lead Connection

- ★ If any of the values obtained do not agree with the above table, the regulator/rectifier must be replaced.

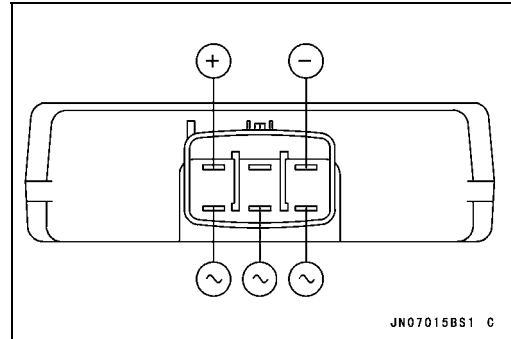
Regulator Inspection

- To test the regulator out of circuit, use three 12 V batteries and a test light (12 V 3 ~6 W bulb in a socket with leads).

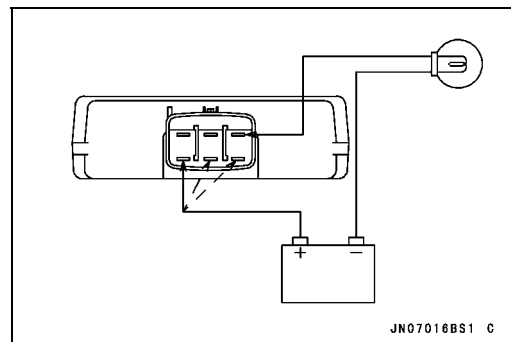
CAUTION

The test light works as an indicator and also as a current limiter to protect the regulator/rectifier from excessive current. Do not use an ammeter instead of a test light.

- Do the 1st step regulator circuit test.
- Connect the test light and the 12 V battery to the regulator/rectifier as shown.
- Check infinity (~) terminals respectively.
- ★ If the test light turns on, the regulator/rectifier is defective. Replace it.
- ★ If the test light does not turn on, continue the test.



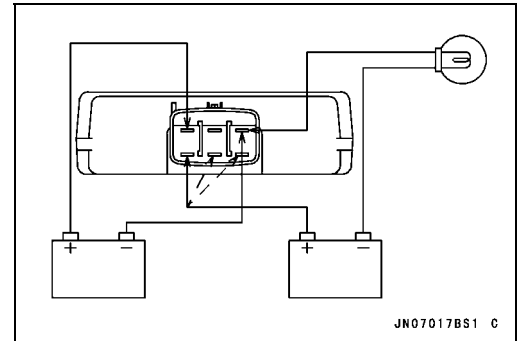
JN07015BS1 C



JN07016BS1 C

Charging System

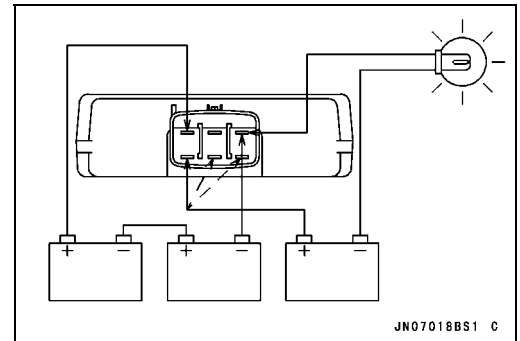
- Do the 2nd step regulator circuit test.
- Connect the test light and the 12 V battery in the same manner as specified in the "1st step regulator circuit test".
- Apply 12 V to the positive (+) terminal.
- Check infinity (∞) terminals respectively.
- ★ If the test light turns on, the regulator/rectifier is defective. Replace it.
- If the test light does not turn on, continue the test.



- Do the 3rd step regulator circuit test.
- Connect the test light and the 12 V battery in the same manner as specified in the "1st step regulator circuit test".
- Momentarily apply 24 V to the positive (+) terminal by adding a 12 V battery.
- Check infinity (∞) terminals respectively.

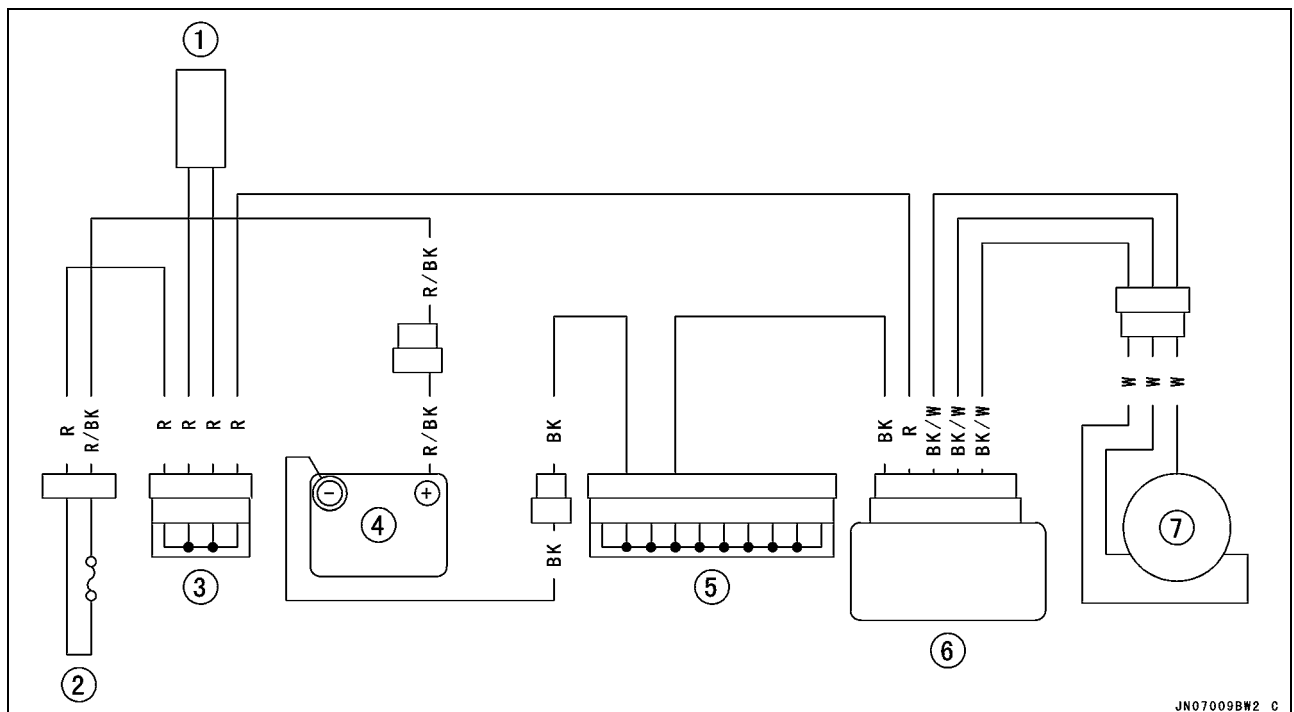
CAUTION

Do not apply more than 24 volts. If more than 24 volts is applied, the regulator/rectifier may be damaged. Do not apply 24 V more than a few seconds. If 24 volts is applied for more than a few seconds, the regulator/rectifier may be damaged.



- ★ If the test light does not light when 24 V is applied momentarily to the positive (+) terminal, the regulator/rectifier is defective. Replace it.
- ★ If the regulator/rectifier passes all the tests described, it may still be defective. If the charging system still does not work properly after checking all the components and the battery, test the regulator/rectifier by replacing it with a known good unit.
- Repeat the test for another regulator/rectifier.

Charging System Circuit



14-36 ELECTRICAL SYSTEM

Charging System

1. Load
2. Main Fuse 20 A
3. Joint Connector R
4. Battery 12 V 18 Ah
5. Joint Connector S
(Ground)
6. Regulator/Rectifier
7. Magneto

Ignition System

⚠ WARNING

The ignition system produces extremely high voltage. Do not touch the spark plugs, ignition coils, or spark plug leads while the engine is running, or you could receive a severe electrical shock.

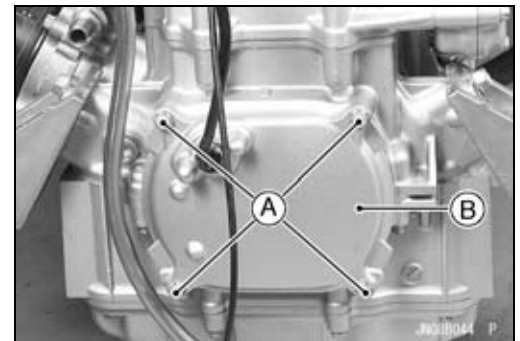
CAUTION

Do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent ECU (Electronic Control Unit) damage.

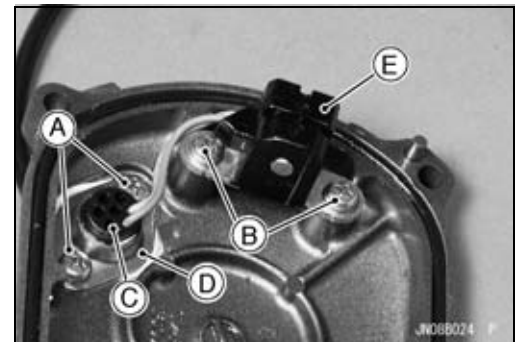
Do not install the battery backwards. The negative side is grounded. This is to prevent damage to the diodes and ECU.

Crankshaft Sensor Removal

- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Crankshaft Sensor Cover Bolts [A]
 - Crankshaft Cover [B]



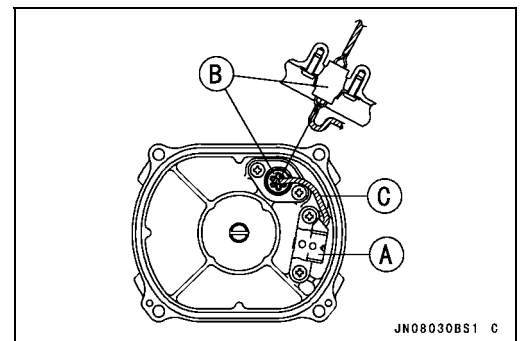
- Unscrew:
 - Rubber Grommet Holder Screws [A]
 - Crankshaft Sensor Screws [B]
- Push out the rubber grommet [C] with the Holder [D].
- Remove the crankshaft sensor [E].



Crankshaft Sensor Installation

- Run the sensor lead through the cover hole.
- Install the crankshaft sensor [A].
- Apply a non-permanent locking agent to the sensor screws.
- Torque - Crankshaft Sensor Screws: 4.4 N·m (0.45 kgf·m, 39 in·lb)**
- Install the rubber grommet [B] in the sensor cover hole.
- Apply water resistant grease to the grommet outside.
- Apply a non-permanent locking agent to the grommet holder screws.
- Run the sensor lead [C] as shown.

Torque - Rubber Grommet Holder Screws: 4.4 N·m (0.45 kgf·m, 39 in·lb)



14-38 ELECTRICAL SYSTEM

Ignition System

- Apply grease to the O-ring and fit it in the groove of the sensor cover.
- Apply silicone sealant [A] to the crankcase halves mating surface on the right and left sides of the crankshaft sensor mount.

Sealant - Kawasaki Bond (Silicone Sealant): 56019-120

- Install the crankshaft sensor cover.

Torque - Crankshaft Sensor Cover Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Install the Engine (see Engine Removal/Installation chapter).

Timing Rotor Removal

- Remove the engine (see Engine Removal).
- Remove the crankshaft sensor cover (see Crankshaft Sensor Removal).
- Remove the timing rotor [A].
- Holding the timing rotor with the flywheel and pulley holder [B] and unscrew the bolt [C].

Special Tools - Flywheel & Pulley Holder: 57001-1605

Flywheel and Pulley Holder Adapter: 57001-1547 [D]

Timing Rotor Installation

- Fit the rotor to the crankshaft.
- Apply a non-permanent locking agent to the rotor bolt.
- Tighten the rotor bolt.

Torque - Timing Rotor Bolt: 20 N·m (2.0 kgf·m, 14 ft·lb)

- Install the crankshaft sensor cover (see Crankshaft Sensor Cover Installation).

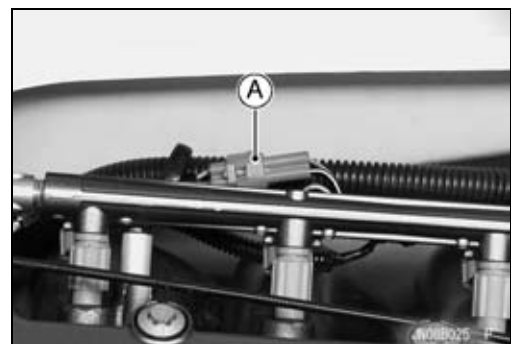
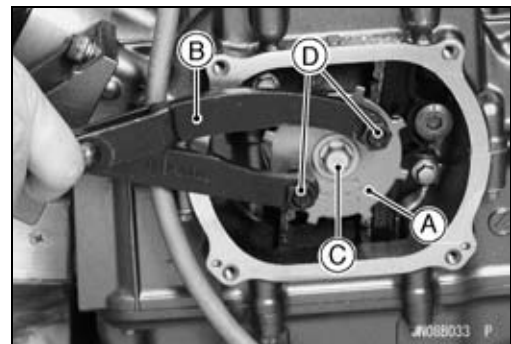
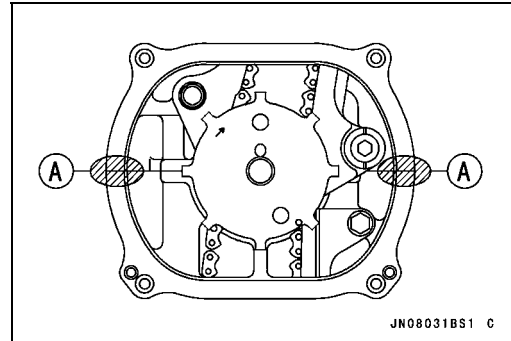
Crankshaft Sensor Inspection

- Remove:
 - Seat (see Hull/Engine Hood chapter)
- Disconnect the 2-pin crankshaft sensor leads connector (Blue) [A].

- Set the hand tester to the $\times 100 \Omega$ range, zero it, and connect it to the crankshaft sensor lead terminals (G and BL) in the connector.
- ★ If there is more resistance than the specified value, the sensor has an open lead and must be replaced. Much less than this resistance means the sensor is shorted, and must be replaced.

Crankshaft Sensor Resistance

Standard: 408 ~ 612 Ω



Ignition System

Ignition Coil Removal

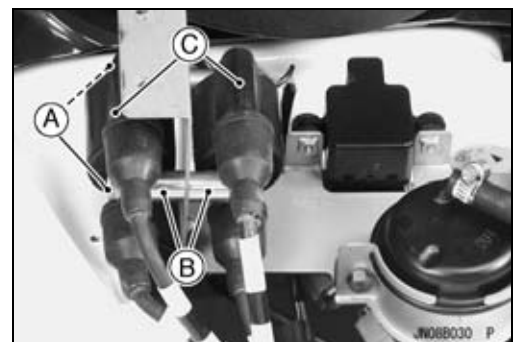
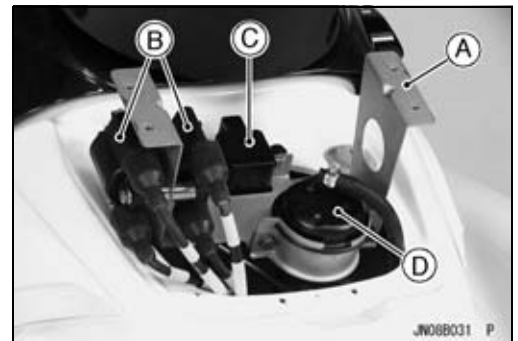
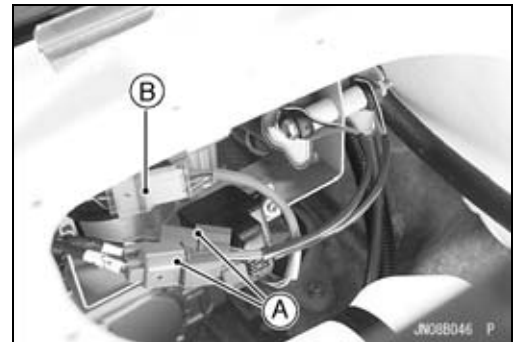
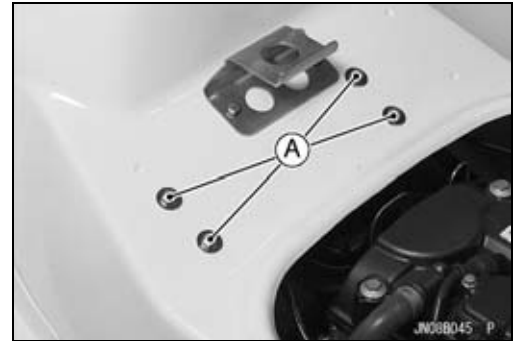
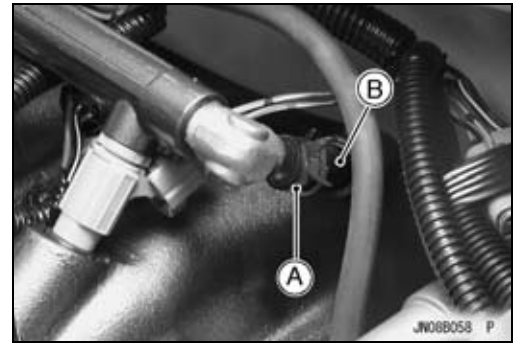
- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Front Storage Pocket (see Hull/Engine Hood chapter)
 - Spark Plug Caps (see Periodic Maintenance chapter)
 - Clamp [A] (JT1200-A1 model)
 - Double Spring Clamp [A] (JT1200-A2 model ~)
 - Fuel Supply Hose End [B]

- Bracket Bolts [A] (see Electric Case Removal/Disassembly).

- Disconnect the ignition coil primary lead connectors [A] and vehicle-down sensor lead connector [B].

- Pull up the bracket [A] together with the ignition coils [B], vehicle-down sensor [C], and fuel filter [D] installed.

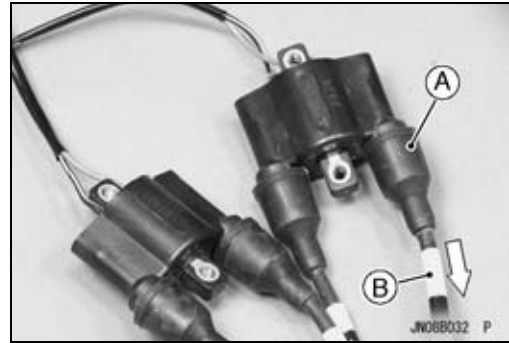
- Unscrew the nuts [A] and remove the bolts, collars [B] and ignition coils [C].



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Ignition System

- Pull out the spark plug lead [B] from the ignition coil [A].
Lubricate the leads with penetrating rust inhibitor.

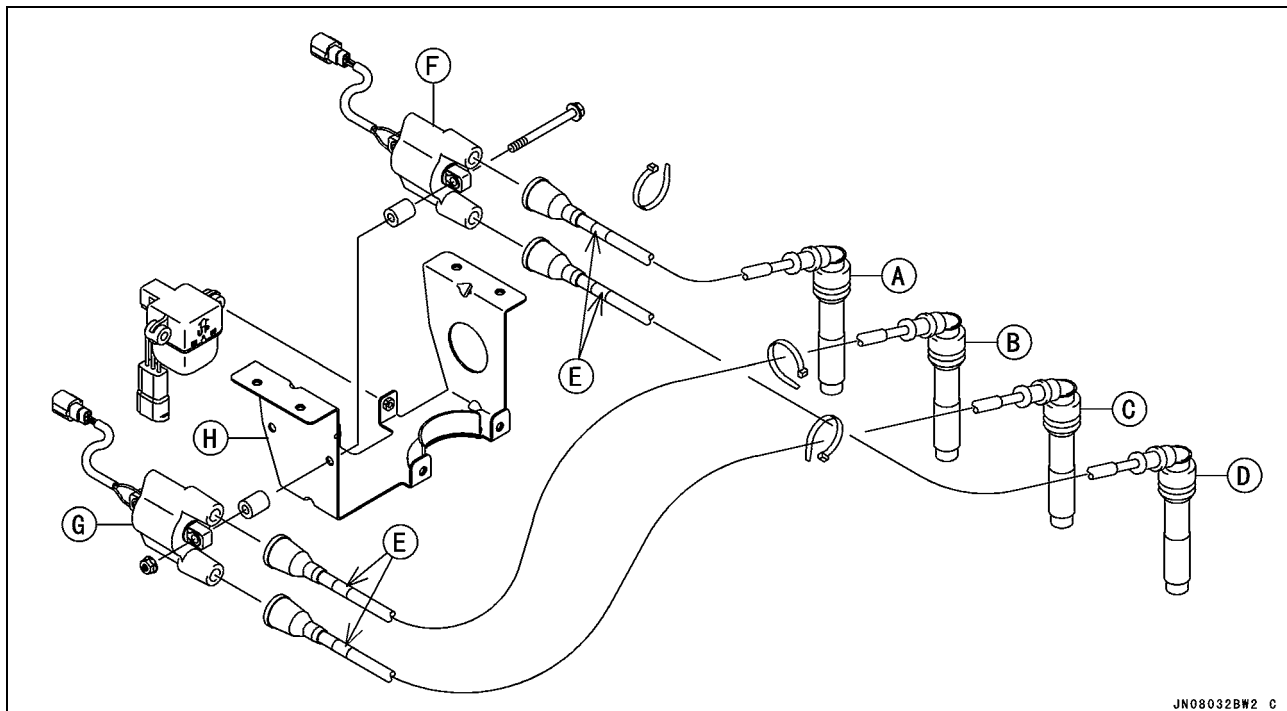


Ignition Coil Installation

- Connect the spark plug lead to each ignition coil as follows.
 - #1 Spark Plug Lead Length 340 mm (13.4 in.) [A]
 - #2 Spark Plug Lead Length 450 mm (17.7 in.) [B]
 - #3 Spark Plug Lead Length 540 mm (21.3 in.) [C]
 - #4 Spark Plug Lead Length 600 mm (23.6 in.) [D]
- Marked [E] is a number of each lead
- Apply a non-permanent locking agent to the ignition coil mounting bolts.
- Install the #1, 4 ignition coil [F] and #2, 3 ignition coil [G] to the bracket [H].

Torque - Ignition Coil Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Apply a non-permanent locking agent to the bracket bolts.



- Install the removal parts.
- For JT1500-A2 model ~; Replace the double spring clamps with new ones. (see Fuel System (DFI) chapter)

Ignition System

Ignition Coil Inspection

Measuring arcing distance

The most accurate test for determining the condition of the ignition coil is made by measuring arcing distance.

- Remove the ignition coil (see Ignition Coil Removal).
- Connect the ignition coil [A] (with the spark plug cap left installed on the spark plug lead) to the tester [B], and measure the arcing distance.

Auxiliary Wires [C]

⚠ WARNING

To avoid extremely high voltage shocks, do not touch the coil or lead.

- ★ If the distance reading is less than the specified value, the ignition coil or spark plug cap is defective.

3 Needle Arcing Distance

Standard: 7 mm (0.28 in.) or more

- To determine which part is defective, measure the arcing distance again with the spark plug leads removed from the ignition coil (see Ignition Coil Removal).
- ★ If the arcing distance is subnormal as before, the trouble is with the ignition coil itself. If the arcing distance is now normal, the trouble is with the spark plug lead.

Measuring coil resistance

If the Coil Tester is not available, the coil can be checked for a broken or badly shorted winding with a hand tester. However, a hand tester can not detect layer shorts and shorts resulting from insulation breakdown under high voltage.

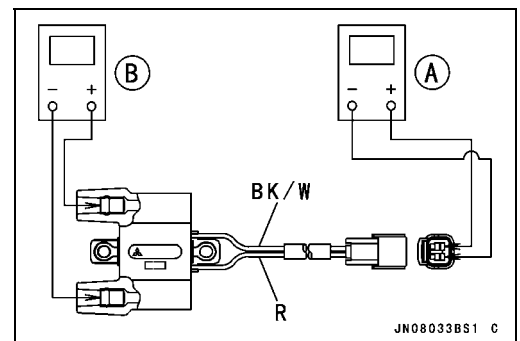
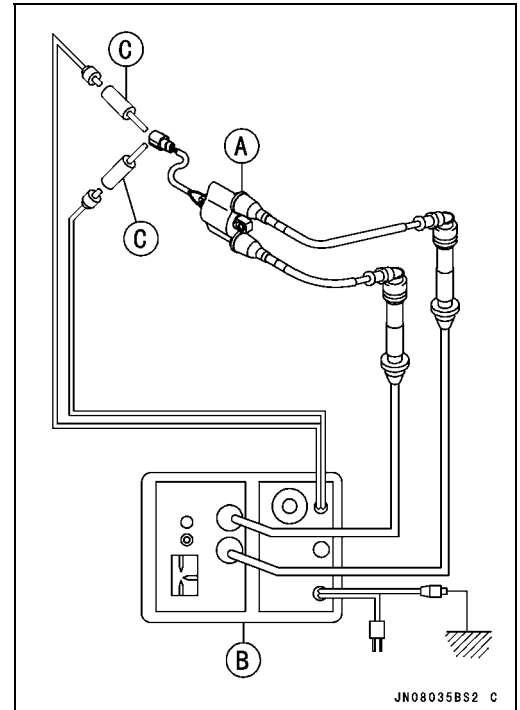
- Disconnect the primary leads from the coil terminals.
- Measure the primary winding resistance as follows [A].
 - Connect the tester between the coil terminals.
 - Set the tester to the $\times 1 \Omega$ range, and read the tester.
- Measure the secondary winding resistance as follows [B].
 - Remove the spark plug leads (see Ignition Coil Removal).
 - Connect the tester between the secondary lead terminals.
 - Set the tester to the $\times 1 \text{ k}\Omega$, and read the tester.
- ★ If the hand tester does not read as specified, replace the coil.

Winding Resistance

Standard: Primary windings 1.53 ~ 2.07 Ω

Secondary windings 12.50 ~ 16.91 k Ω

- ★ If the tester reads are as specified, the ignition coil windings are probably good. However, if the ignition system still does not perform as it should after all other components have been checked, test replace the coil with one known to be good.



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Ignition System

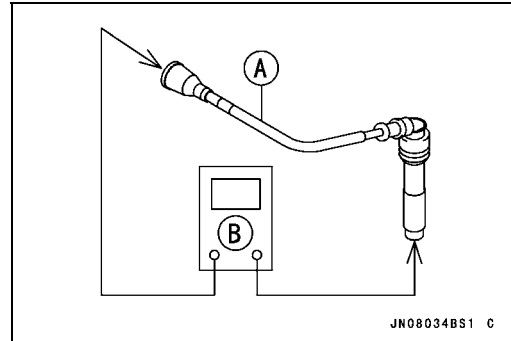
Measuring spark plug lead resistance

- Check the spark plug lead [A] for visible damage.
- ★ If the spark plug lead is damaged, replace the spark plug lead.
- Measure the lead resistance with the hand tester [B].

Spark Plug Lead Resistance

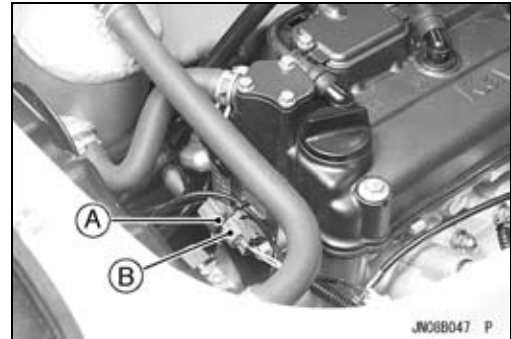
Standard: 3.75 ~ 6.25 k Ω

- ★ If the hand tester does not read as specified, replace the lead

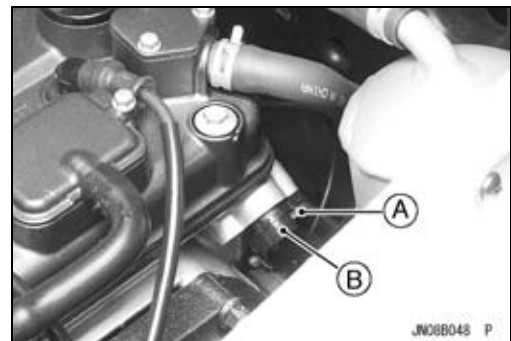


Camshaft Position Sensor Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
- Cut off the clamp [A].
- Disconnect the camshaft position sensor lead connector [B].



- Remove:
 - Camshaft Position Sensor Bolt [A]
 - Camshaft Position Sensor [B]



Camshaft Position Sensor Installation

- Apply grease or engine oil to the O-ring on the camshaft position sensor.
- Tighten:
 - Torque - Camshaft Position Sensor Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)

Ignition System

Camshaft Position Sensor Inspection

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Camshaft Position Sensor Lead Connector [A] (disconnect)
- Set the hand tester [B] to the $\times 10 \Omega$ range and connect it to the yellow and black leads in the connector.

Special Tool - Hand Tester: 57001-1394

- ★ If there is more resistance than the specified value, the sensor coil has an open lead and must be replaced. Much less than this resistance means the sensor coil is shorted, and must be replaced.

Camshaft Position Sensor Resistance: 400 ~ 460 Ω

- Using the highest resistance range of the tester, measure the resistance between the camshaft position sensor leads and chassis ground.
- ★ Any tester reading less than infinity (∞) indicates a short, necessitating replacement of the camshaft position sensor.

Igniter Removal/Installation

- Refer to ECU Removal in the Fuel System (DFI) chapter.

Igniter Inspection

- The igniter is built in the ECU (Electronic Control Unit).

CAUTION

Do not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent igniter in the ECU damage.

Ignition Coil Primary Peak Voltage Check

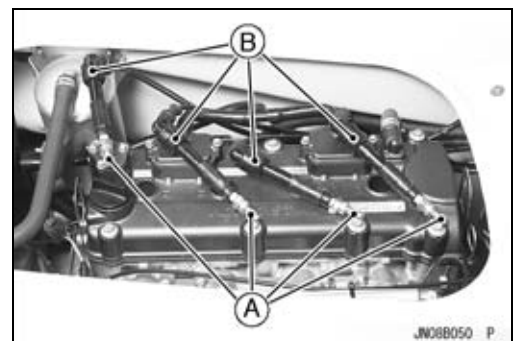
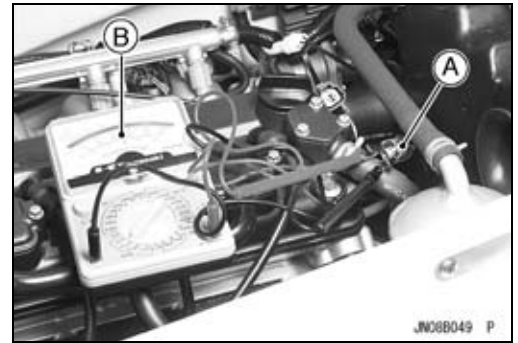
NOTE

○ Be sure the battery is fully charged.

- Remove:
 - Seat (see Hull/Engine Hood chapter)
- Pull all the spark plug caps from the spark plugs.
- Install the new spark plugs [A] into each plug caps [B], and ground them onto the engine.

NOTE

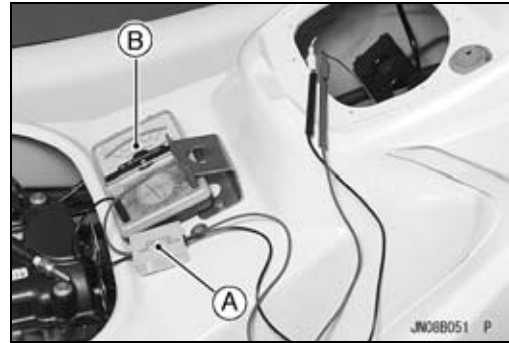
○ Maintain the correct value of compression pressure for the cylinder (Be sure to measure the voltage with the spark plug installed to the cylinder head).



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Ignition System

- Remove:
Front Storage Pocket (see Hull/Engine Hood chapter)
- Install the peak voltage adapter [A] into the hand tester [B].



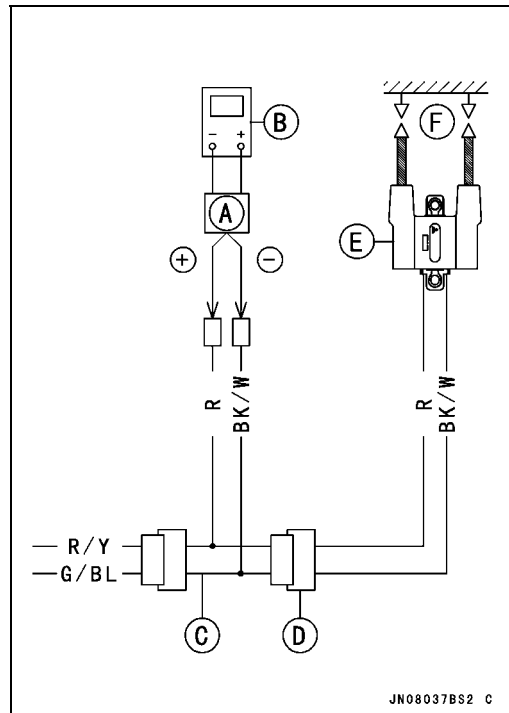
- Connect the peak voltage adapter [A] to the ignition coil primary lead connector [D], using the harness adapter [C].
Hand Tester [B]
Ignition Coil [E]
Spark Plugs [F]

Special Tools - Hand Tester: 57001-1394
Harness Adapter: 57001-1562
Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B

Hand Tester Range: × DC 1 000 V

Primary Lead Connections

	Adapter (R, +)		Adapter (BK, -)
#1, 4 Ignition Coil:	R	↔	BK/W (Ground)
#2, 3 Ignition Coil:	R	↔	BK/W (Ground)



⚠ WARNING

To avoid extremely high voltage shocks, do not touch the spark plugs or tester connections.

- Turn the ignition switch on and push the lanyard key under the stop button.
- Pushing the starter button, crank the engine 4 ~ 5 seconds to measure the primary peak voltage.
- Do not operate the starter for longer than 5 seconds. Wait 15 seconds before using it again.
- Repeat the measurements 5 or more times for one ignition coil.

Ignition Coil Primary Peak Voltage

Standard: 250 V or more

- Repeat the test for the other ignition coil.
- ★ If the reading is less than the specified value, see “Ignition System Troubleshooting” table to determine whether igniter is good or no good.

Ignition System

Crankshaft Sensor Peak Voltage Check

NOTE

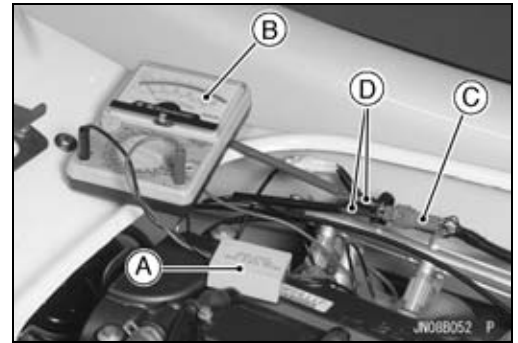
○ Be sure the battery is fully charged.

- Connect the peak voltage adapter [A] to the hand tester [B].

Special Tool - Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B

- Connect the adapter the crankshaft sensor lead connector [C], using the needle adapter set [D].

Special Tools - Hand Tester: 57001-1394
Needle Adapter Set: 57001-1457



Connections

	Adapter (R, +)	Adapter (BK, -)
Crankshaft Sensor:	G	←→ BL

Hand Tester Range: × DC 10 V

- Turn the ignition switch on and push the lanyard key under the stop button.
- Pushing the starter button, crank the engine 4 ~ 5 seconds to measure the crankshaft sensor peak voltage.
- Do not operate the starter for longer than 5 seconds. Wait 15 seconds before using it again.
- Repeat the measurements 5 or more times.

Crankshaft Sensor Peak Voltage
Standard: 2.5 V or more

- ★ If the reading is less than the specified value, check the crankshaft sensor (see Crankshaft Sensor Inspection).

Camshaft Position Sensor Peak Voltage Inspection

- Remove:
 Seat (see Hull/Engine Hood chapter)
- Set the digital meter [B] to the 10 V DC range.
- Connect the peak voltage adapter [C] to the digital meter.

Special Tool - Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B

- Connect the peak voltage adapter to the camshaft sensor lead connector [D], using the needle adapter set [A].

Special Tool - Needle Adapter Set: 57001-1457

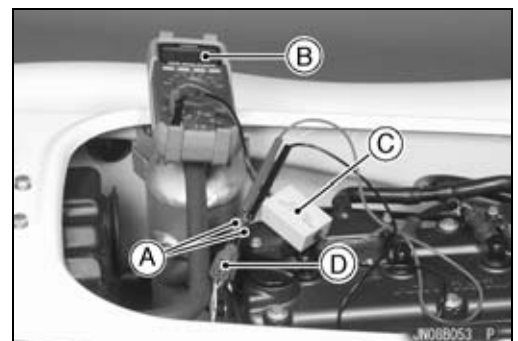
Connections

Camshaft Sensor Lead	Adapter	Hand Tester
Black	← Red	→ (+)
Yellow	← Black	→ (-)

- Turn the ignition switch and engine stop switch on.
- Pushing the starter button, turn the engine 4 ~ 5 seconds to measure the camshaft position sensor peak voltage.
- Repeat the measurement 5 or more times.

Camshaft Position Sensor Peak Voltage
Standard: 0.4 V or more

- ★ If the peak voltage is lower than the standard, inspect the camshaft position sensor.



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Ignition System

Spark Plug Removal

- Refer to Spark Plug Inspection in the Periodic Maintenance chapter.

Spark Plug Installation

- Refer to Spark Plug Inspection in the Periodic Maintenance chapter.

Spark Plug Inspection

- Refer to Spark Plug Inspection in the Periodic Maintenance chapter.

Spark Plug Adjustment

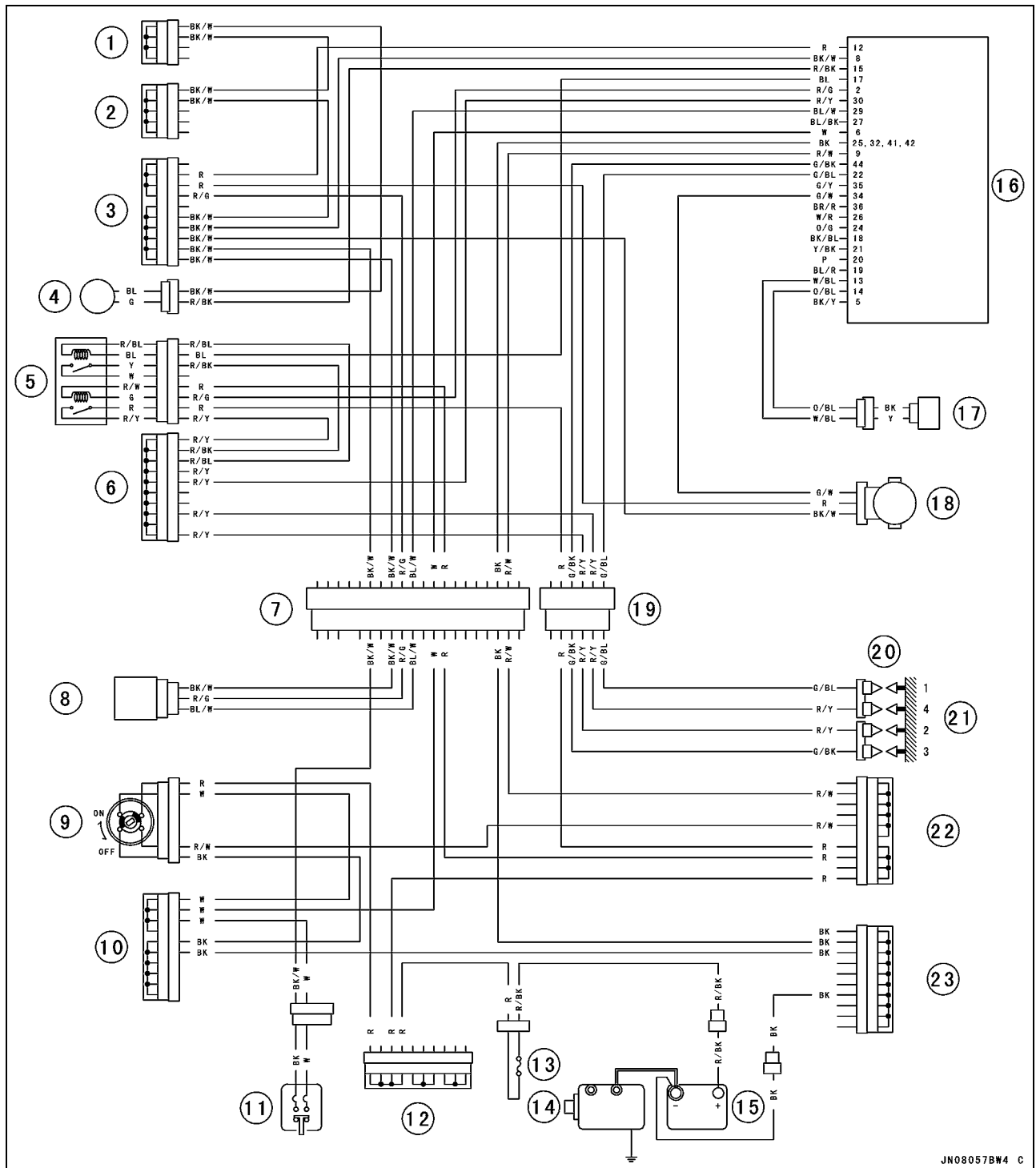
- Refer to Spark Plug Adjustment in the Periodic Maintenance chapter.

Spark Plug Cleaning

- Refer to Spark Plug Cleaning in the Periodic Maintenance chapter.

Ignition System

Ignition System Circuit

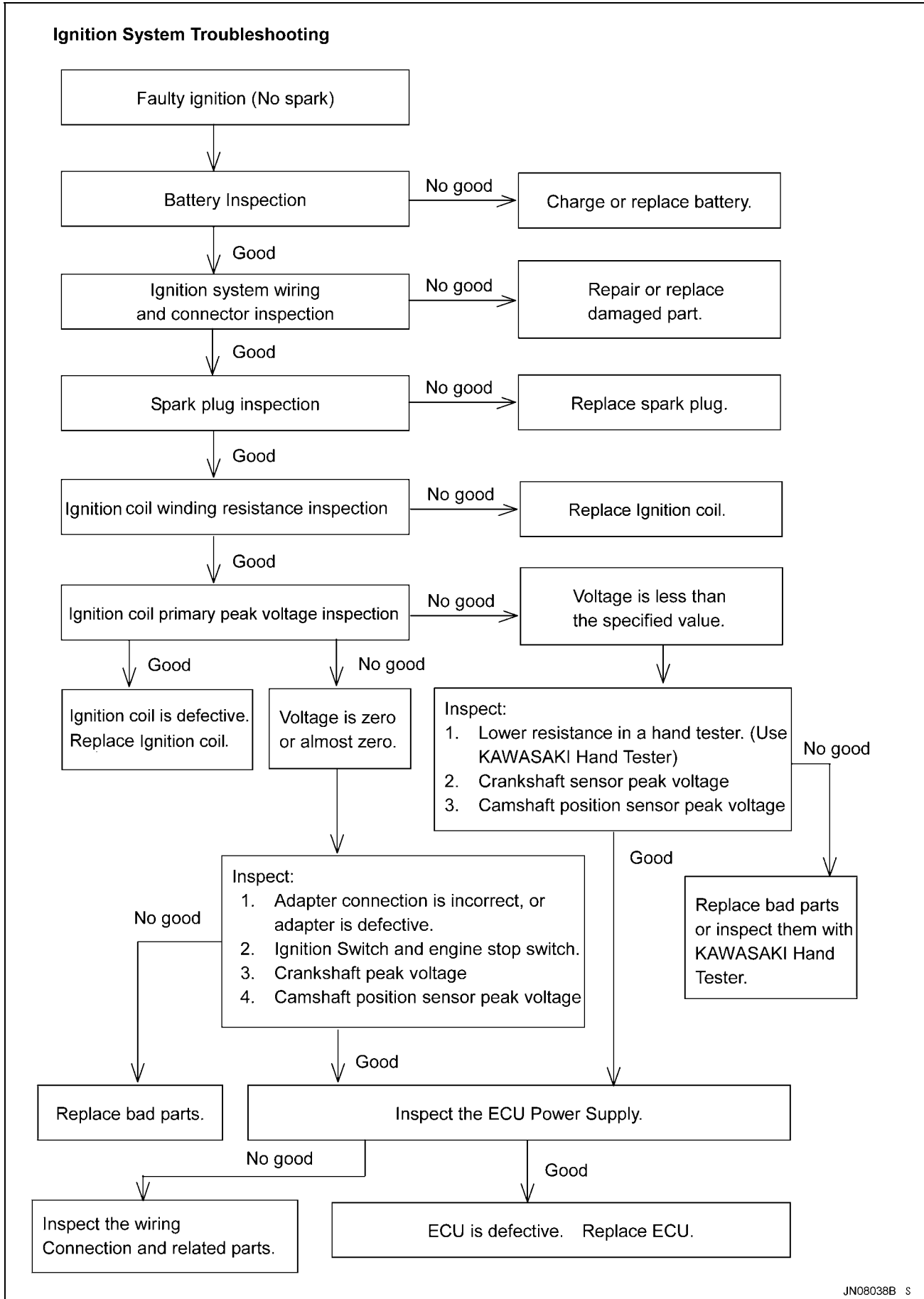


JN08057BW4 C

- | | | |
|--|---------------------------------|------------------------------|
| 1. Joint Connector H | 9. Ignition Switch | 17. Camshaft Position Sensor |
| 2. Joint Connector J | 10. Joint Connector Q | 18. Throttle Sensor |
| 3. Joint Connector E | 11. Engine Stop Switch | 19. Connector D |
| 4. Crankshaft Sensor | 12. Joint Connector R | 20. Ignition Coils |
| 5. Relay Assembly (Main Relay/Fuel Pump Relay) | 13. Main Fuse 20 A | 21. Spark Plugs |
| 6. Joint Connector F | 14. Starter Motor | 22. Joint Connector P |
| 7. Connector C | 15. Battery 12 V 18 Ah | 23. Joint Connector S |
| 8. Vehicle-down Sensor | 16. ECU (Electric Control Unit) | |

14-48 ELECTRICAL SYSTEM

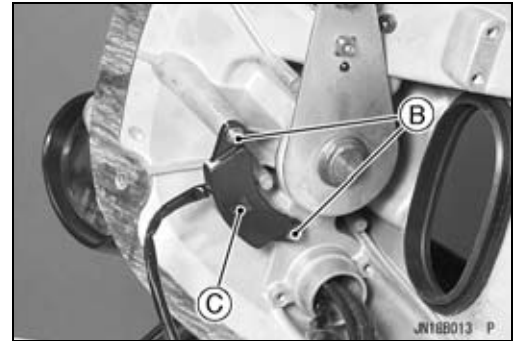
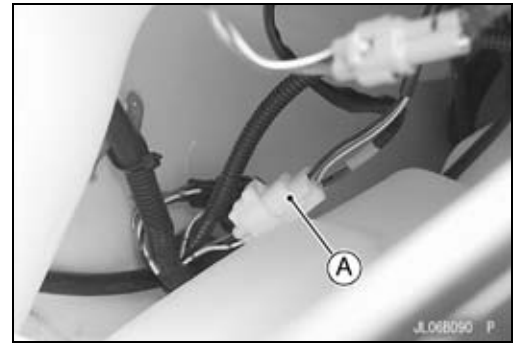
Ignition System



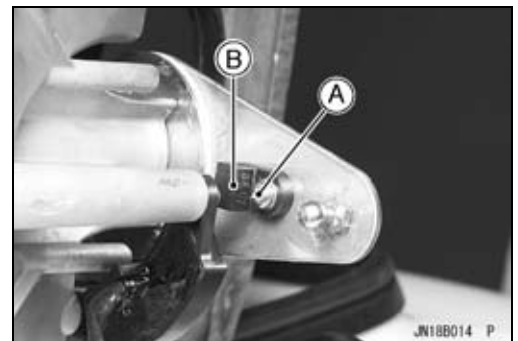
Kawasaki Smart Steering System

Steering Position Sensor and Magnet Removal

- Remove the steering holder (see Steering Removal in Steering chapter).
- Remove or disconnect:
 - Steering Position Sensor Lead Connector [A]
 - Leads Clamp on Steering Holder
 - Steering Position Sensor Mounting Screws [B]
 - Steering Position Sensor [C]

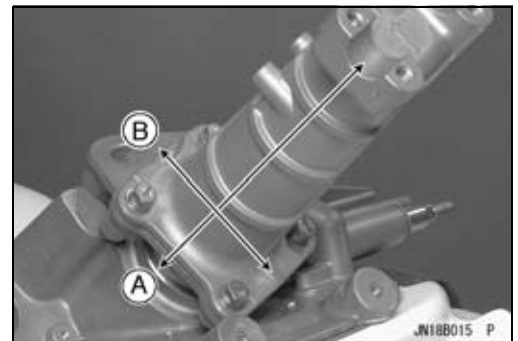


- Unscrew the mounting screw [A] and remove the magnet [B].

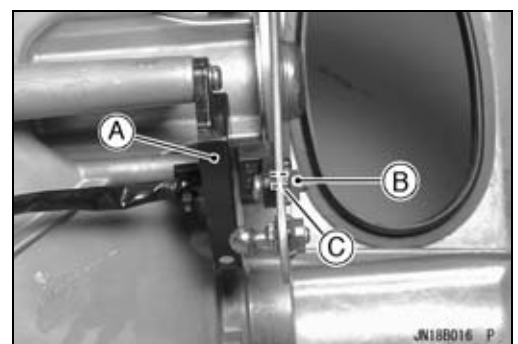


Steering Position Sensor and Magnet Installation

- Moving the steering shaft in the direction [A] and [B], check the steering shaft for excessive play.
- ★ If necessary, adjust the steering shaft nut or replace the bushings.



- Apply a non-permanent locking agent to the steering position sensor mounting screws and magnet mounting screw.
- Install the steering position sensor [A] to the steering holder and align the projection [B] on the magnet with the hole [C] on the steering shaft plate.



14-50 ELECTRICAL SYSTEM

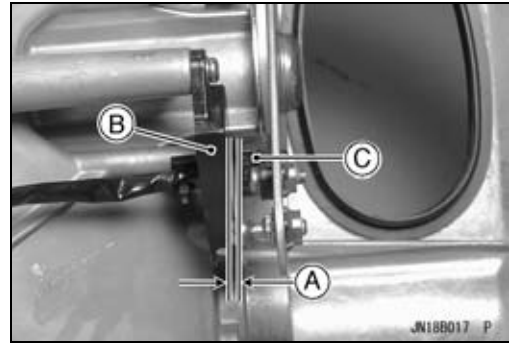
Kawasaki Smart Steering System

- Turning the steering shaft fully in left and right direction, check whether the steering position sensor comes in contact with the magnet.
- Check the clearance [A] between the steering position sensor [B] and the magnet [C] with feeler gauge.

Steering Position Sensor Clearance

Standard: 0.5 ~ 1.5 mm (0.02 ~ 0.06 in.)

- ★ If necessary, adjust the steering shaft nut.
- Check the operation of Kawasaki Smart Steering system.



Inspection of Kawasaki Smart Steering System

- Inspect the smart steering system with the watercraft in the water.
- Center the handlebar in the straight-ahead position .
- Squeeze the throttle lever and allow it to approx. 4 000 rpm or above for 4 seconds or more.
- Release the throttle lever.
- Within 1 second, turn the handlebar all the way to the left or right and check the engine speed increases to approx. 2 800 rpm.
- Center the handlebar in the straight-ahead position, and check the engine speed decreases to an idle speed.
- ★ If the Kawasaki Smart Steering system does not operate normally, check the steering position sensor clearance.

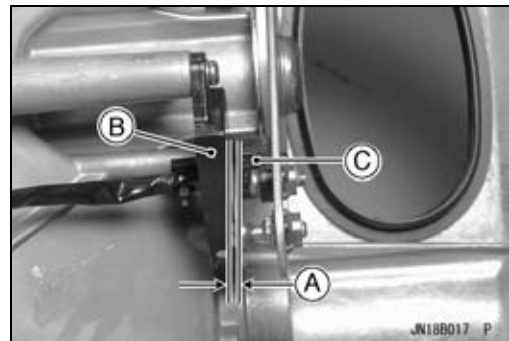
Steering Position Sensor Clearance

- Check the clearance [A] between the steering position sensor [B] and the magnet [C] with feeler gauge.

Steering Position Sensor Clearance

Standard: 0.5 ~1.5 mm (0.02 ~ 0.06 in.)

- ★ If the clearance is the specified value, inspect steering position sensor input voltage.
- ★ If necessary, adjust the steering shaft nut.



Kawasaki Smart Steering System

Steering Position Sensor Input Voltage Inspection

- Measure the input voltage to the steering position sensor.

NOTE

○ Be sure the battery is fully charged.

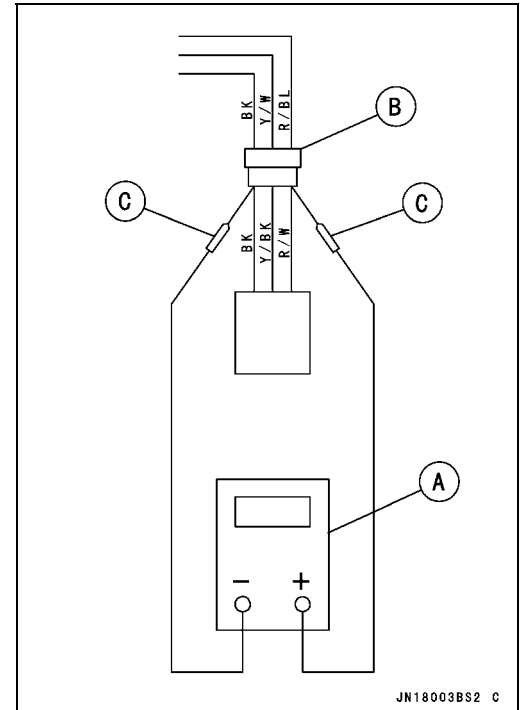
- Connect a digital voltmeter [A] to the lead connector [B] of the steering position sensor using the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Connections to Steering Position Sensor Connector

Meter (+) → R/W Terminal

Meter (-) → BK Terminal



JN18003BS2 C

- Turn the ignition switch ON.
- Center the handlebar in the straight-ahead position.
- Measure the input voltage.

Steering Position Sensor Input Voltage

Standard: Battery Voltage

- Turn the ignition switch OFF.
- ★ If the reading is good, inspect steering position sensor output voltage.
- ★ If the reading is out of the standard, check the following.
 - Battery Voltage
 - 20 A Main Fuse
 - Power Source Wiring (see Steering Position Sensor Circuit)

14-52 ELECTRICAL SYSTEM

Kawasaki Smart Steering System

Steering Position Sensor Output Voltage Inspection

- Measure the output voltage from the steering position sensor.

NOTE

○ Be sure the battery is fully charged

- Connect a digital voltmeter [A] to the lead connector [B] of the steering position sensor using the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Connections to Steering Position Sensor Connector

Meter (+) → Y/BK Terminal

Meter (-) → BK Terminal

- Turn the ignition switch ON.
- Turn the handlebar fully left or right.
- Measure the output voltage.

Steering Position Sensor Output Voltage

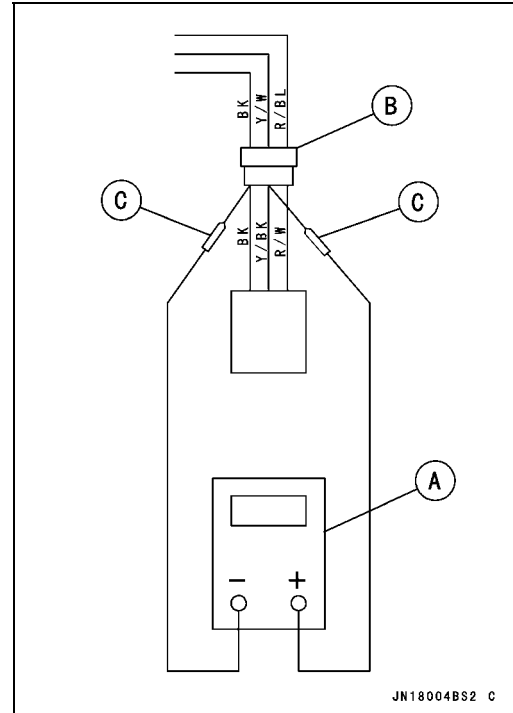
Standard: approx. 0 V

NOTE

○ When the handlebar is centered in straight-ahead position the output voltage standard value is battery voltage.

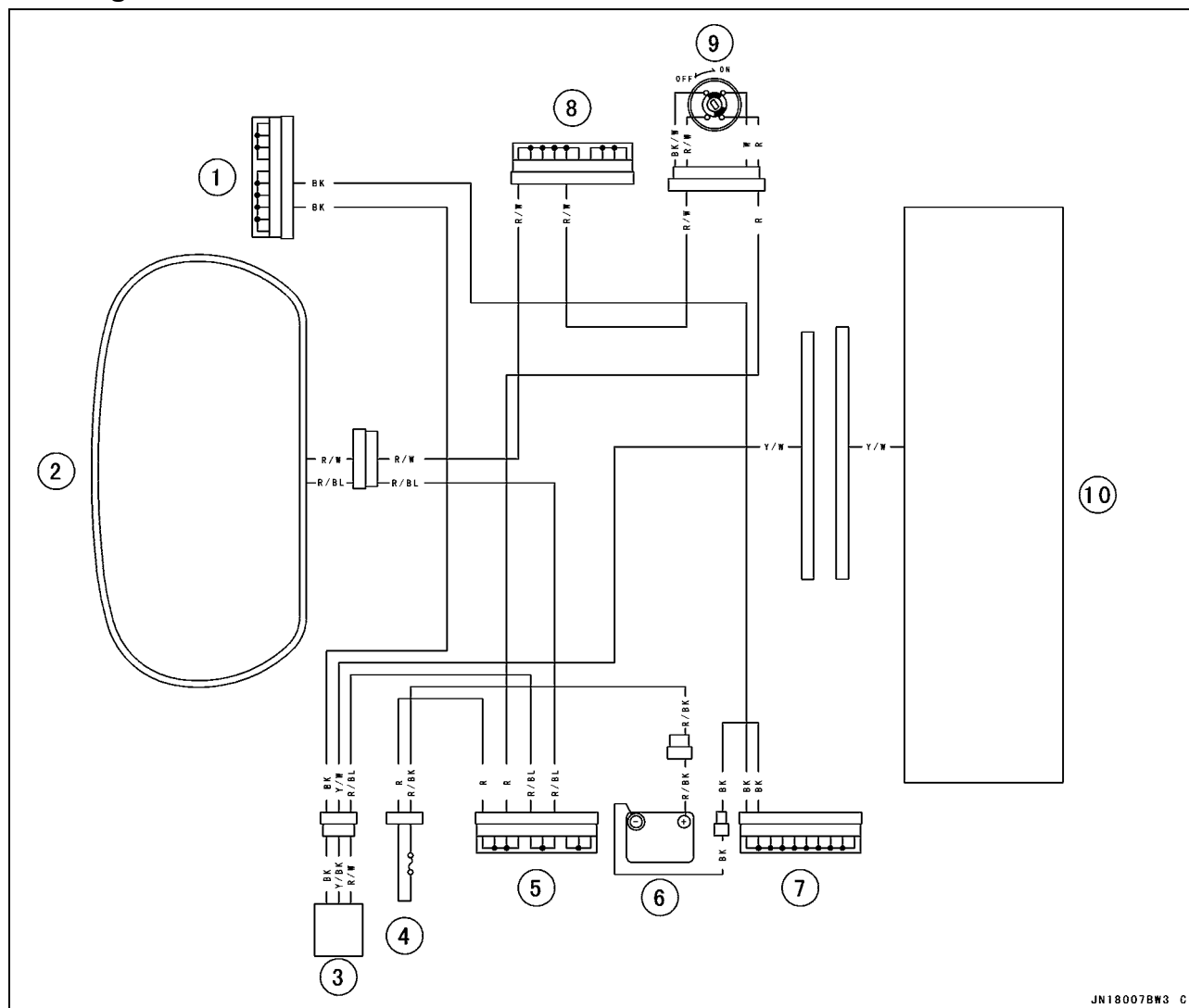
- Turn the ignition switch OFF.

- ★ If the reading is out of the standard, suspect the following.
 - Damaged Steering Position Sensor
 - Open Sensor Circuit
- ★ If the reading is the standard, but the Kawasaki Smart Steering system does not operate, suspect the ECU and idle speed control in the throttle body.



Kawasaki Smart Steering System

Steering Position Sensor Circuit



JN18007BW3 C

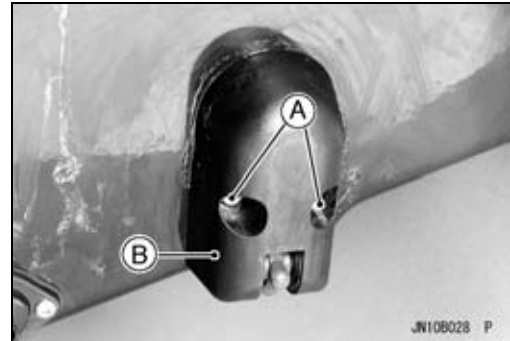
1. Joint Connector Q
2. Multifunction Meter
3. Steering Position Sensor
4. 20 A Main Fuse
5. Joint Connector R
6. Battery
7. Joint Connector S
8. Joint Connector P
9. Ignition Switch
10. ECU (Electronic Control Unit)

14-54 ELECTRICAL SYSTEM

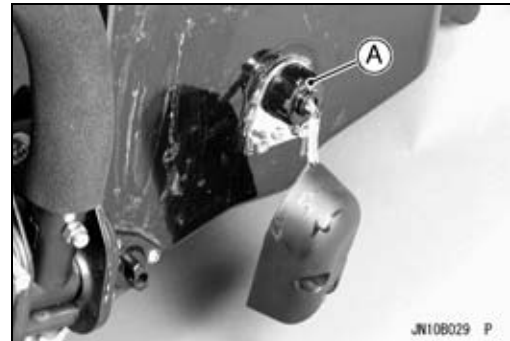
Sensors

Speed Sensor Removal/Installation

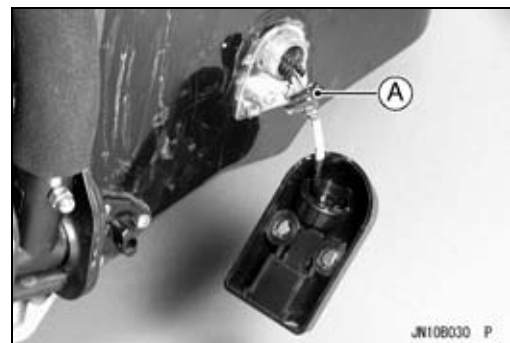
- Unscrew the mounting bolts [A] and remove the speed sensor assembly [B].



- Unscrew the cap [A].
- Pull out the speed sensor connector and disconnect it.

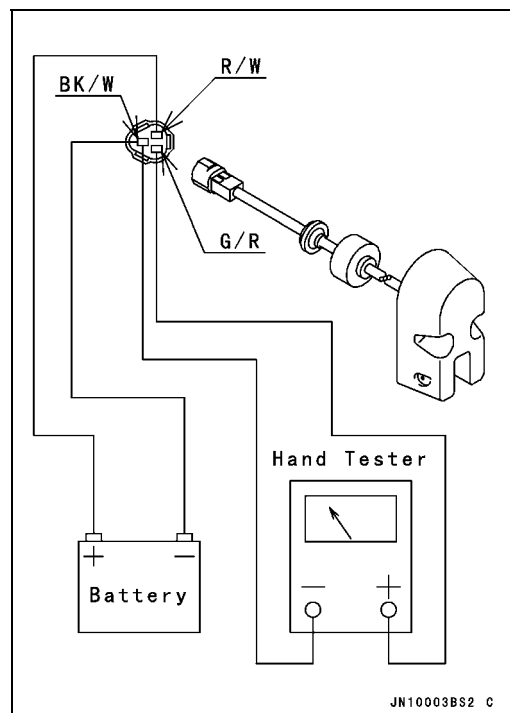


- When installing the speed sensor assembly, note the following.
 - Apply silicone sealant around the grommet [A] and lead wires.



Speed Sensor Inspection

- Remove the speed sensor.
- Connect the battery and tester leads to the sensor as shown.



Sensors

- Rotate the waterwheel by hand slowly.
- Measure the output voltage of the speed sensor.

**G/R (+), BK/W (-) → 0 ~ battery voltage; twice a rotation
(Rotate it slowly.)**

- ★ If the voltage does not rise from zero to battery voltage twice a rotation, replace the sensor.



- Measure the output voltage of the sensor at higher speeds.

○ Rotate the waterwheel in a fair speed by air.

G/R (+), BK/W (-) → approx. 5 V

- ★ If the sensor voltage does not reach 5 volts when spun with compressed air, replace the sensor.

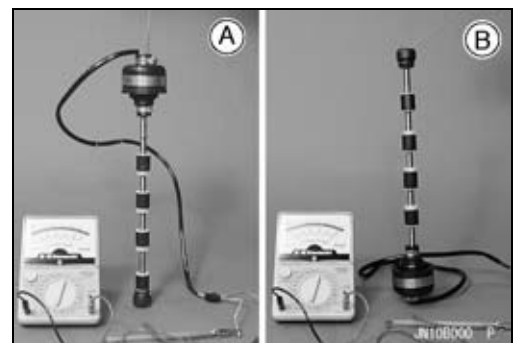


Fuel Level Sensor Inspection

- Open the front storage compartment cover.
- Disconnect the fuel level sensor 2-pin connector.
- Loosen the clamp, and remove the fuel level sensor out of the fuel tank.
- Set the hand tester (ohmmeter) to the $\times 1 \text{ k}\Omega$ range.

Special Tool - Hand Tester: 57001-1394

- Connect the tester leads the W/R and BK/W leads to check the switching operation of the float.

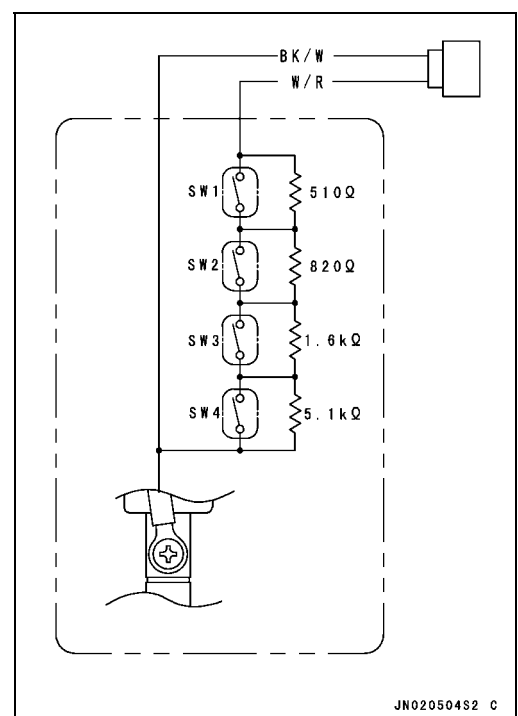


Meter Reading

When sensor is held upright [A]: approx. 8.03 k Ω

When sensor is held upside down [B]: approx. 0 Ω

- ★ The meter should read as specified. If it does not, replace the fuel level sensor.



Throttle Sensor Removal/Installation

- Refer to Throttle Sensor Removal/Installation in the Fuel System chapter.

14-56 ELECTRICAL SYSTEM

Sensors

Throttle Sensor Inspection

- Refer to Throttle Sensor Section in the Fuel System chapter.

Water Temperature Sensor Inspection

- Remove the water temperature sensor (see Fuel (DFI) System chapter).
- Suspend the sensor [A] in a container of water so that the temperature-sensing projection is submerged.
- Suspend an accurate thermometer [B] in the water.

NOTE

○ *The sensor and thermometer must not touch the container side or bottom.*

- Place the container over a source of heat and gradually raise the temperature of the water while stirring the water gently.
- Using the hand tester, measure the internal resistance of the sensor at the temperatures shown in the table.
- ★ If the hand tester does not show the specified values, replace the sensor.

Water Temperature Sensor Resistance

Water Temperature	Sensor Resistance
20°C (68°F)	approx. 293 kΩ
50°C (122°F)	approx. 78.5 kΩ
90°C (194°F)	approx. 18.1 kΩ
100°C (212°F)	approx. 13.2 kΩ

Inlet Air Temperature Sensor Inspection

- Refer to Inlet Air Temperature Sensor Section in the Fuel System chapter.

Oil Temperature Sensor Inspection

- Remove the oil temperature sensor (see Fuel (DFI) System chapter).
- Suspend the sensor [A] in a container of water so that the temperature-sensing projection is submerged.
- Suspend an accurate thermometer [B] in the water.

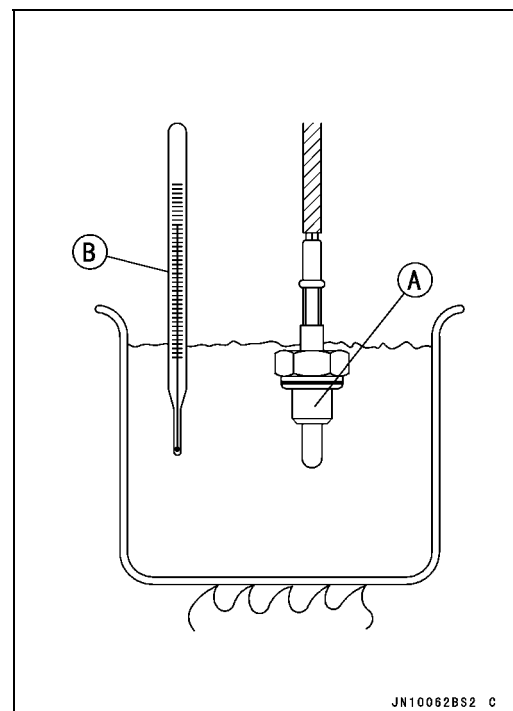
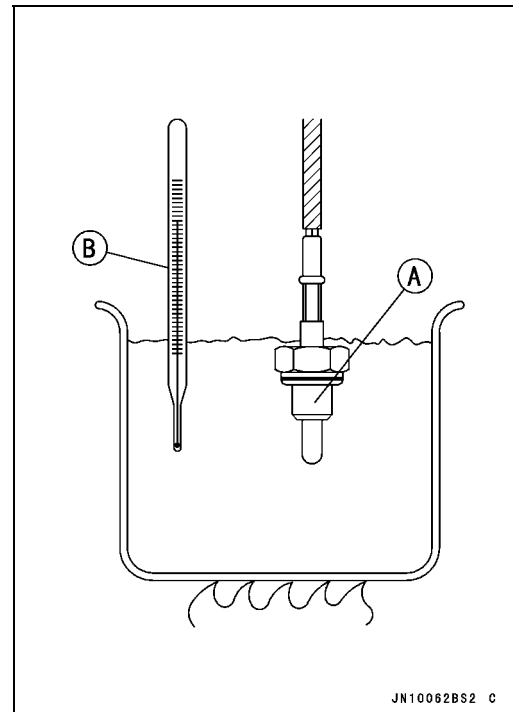
NOTE

○ *The sensor and thermometer must not touch the container side or bottom.*

- Place the container over a source of heat and gradually raise the temperature of the water while stirring the water gently.
- Using the hand tester, measure the internal resistance of the sensor at the temperatures shown in the table.
- ★ If the hand tester does not show the specified values, replace the sensor.

Oil Temperature Sensor Resistance

Oil Temperature	Sensor Resistance
20°C (68°F)	approx. 293 kΩ
50°C (122°F)	approx. 78.5 kΩ
90°C (194°F)	approx. 18.1 kΩ
100°C (212°F)	approx. 13.2 kΩ



Multifunction Meter

Display Function Inspection

- Using the auxiliary wires, connect the 12 V battery [A] to the meter unit [B] connector as follows.

JT1500-A2 model ~ [C]

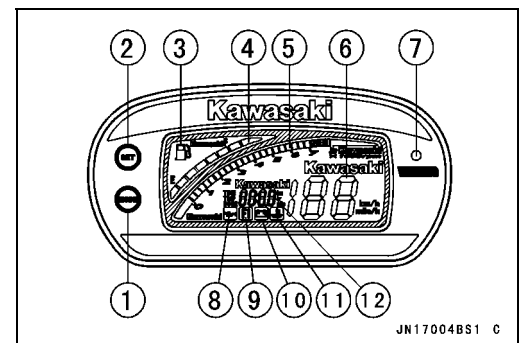
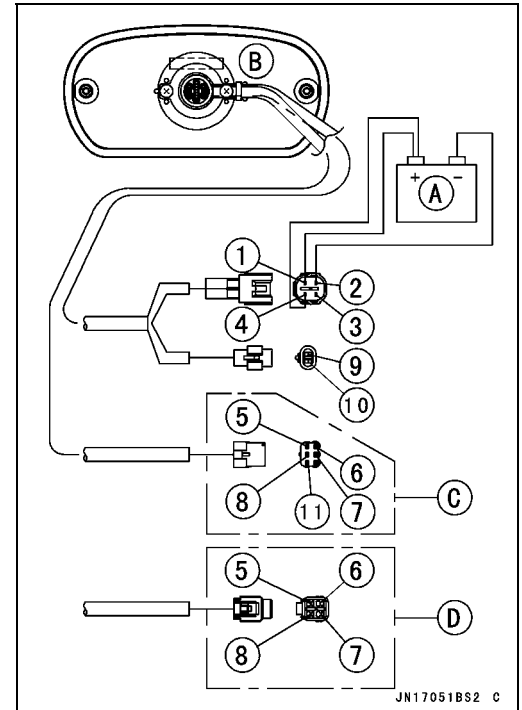
JT1500-A1 model [D]

- Connect the battery positive terminal to the terminal [1].
 - Connect the battery negative terminal to the terminal [2].
- [1] R Battery (+)
 [2] BK, Ground (-)
 [3] R/BL, Speed Sensor
 [4] R/W Ignition Switch (+)
 [5] W/R, Fuel Level Sensor
 [6] BL/BK, Diagnosis Signal
 [7] GY, Tachometer Pulse
 [8] G/R, Speed Sensor Pulse
 [9] BK/W, Buzzer (-)
 [10] R/BK, Buzzer (+)
 [11] Y/BL, SLO (Smart Learning Operation) Mode

Battery Voltage Range: 10 ~ 16 V

- When the positive terminal (+) of battery is connected to the terminal [4] completely, inspect that every LCD segment and LED warning light will be lit for several seconds just after disappearance of demonstrative figure-expression.
- Check that when the terminals are disconnected, all the LCD segments and LED warning light disappear.
- ★ If the LCD segments and LED warning light will not appear, replace the meter assembly.

- [1] MODE Button
 [2] SET Button
 [3] Fuel Indicator
 [4] Fuel Level Gauge
 [5] Tachometer
 [6] Speedometer
 [7] "LED" Warning Light
 [8] Engine Oil Pressure Indicator
 [9] FI Indicator
 [10] Low Battery Voltage Indicator
 [11] Engine Cooling Water Temperature Indicator
 [12] Multifunction Display



CAUTION

Do not drop the meter unit. Do not short the terminals.

If the multifunction meter displays incorrectly while the engine is running, first disconnect the (-) battery terminal lead and reconnect it again to recover the meter display.

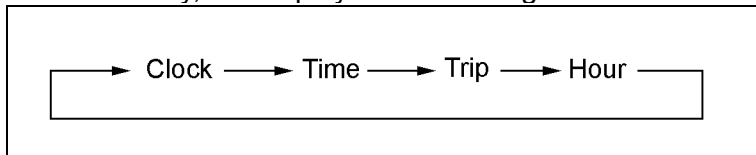
Then, check to see that the standard plugs and/or plug caps are installed. Install only the standard plugs and/or plug caps. The resistors are embedded in both parts.

14-58 ELECTRICAL SYSTEM

Multifunction Meter

MODE/SET Button Inspection

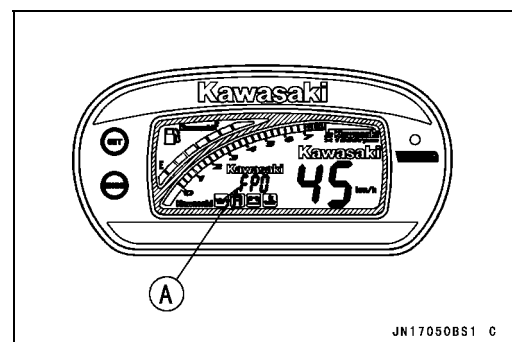
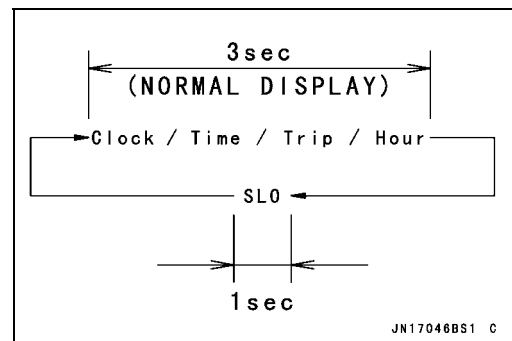
- Check that when the MODE button is pushed and held continuously, the display rotates through the four modes.



- Indicate the clock mode.
- Check that when the SET button is pushed for more than two seconds, the meter display turns to the clock set mode.
- ★ If the display function does not work, replace the meter assembly.
- Indicate the time mode.
- Check that when the SET button is pushed for more than two seconds, the meter display turns to “00:00”.
- ★ If the display function does not work, replace the meter assembly.
- Indicate the trip mode.
- Check that when the SET button is pushed for more than two seconds, the meter display turns to “000.0”.
- ★ If the display function does not work, replace the meter assembly.

SLO (Smart Learning Operation) Mode Inspection (JT1500-A2 model ~)

- Confirmation of the SLO mode shift.
 - To change the normal operation mode to SLO mode, push the “MODE” button for 7 seconds or more.
 - The same initial display as shown when ignition switch turned on is shown together with two times buzzer sound.
 - Then “SLO” (1 second) and normal display (Clock/Time/Trip/Hour) (3 seconds) are shown blinking alternately.
- Confirmation of the normal operation mode shift.
 - To change the SLO mode to normal operation mode, push the “MODE” button for 7 seconds or more.
 - The same initial display is first shown and followed by “FPO” [A] for 2 seconds.
 - However “FPO” is shown only once when shifted and not displayed thereafter.
 - ★ If the display function does not work, replace the meter assembly.



Multifunction Meter

Fuel Level Gauge/Symbol/FUEL Characters/Warning Light Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Inspection”.
- Connect the variable rheostat [A] to the terminal [5] as shown.

JT1500-A2 model ~ [B]

JT1500-A1 model [C]

- Check that the number of segments matches the resistance value of the variable rheostat.

Resistance Value (Ω)	Display Segments
8030	0*
2930	1 ~ 2
1330	3 ~ 4
510	5 ~ 6
0	7 ~ 8

*: The LED warning light, fuel symbol and FUEL characters flash at the same time.

- If any display function does not work, replace the meter assembly.

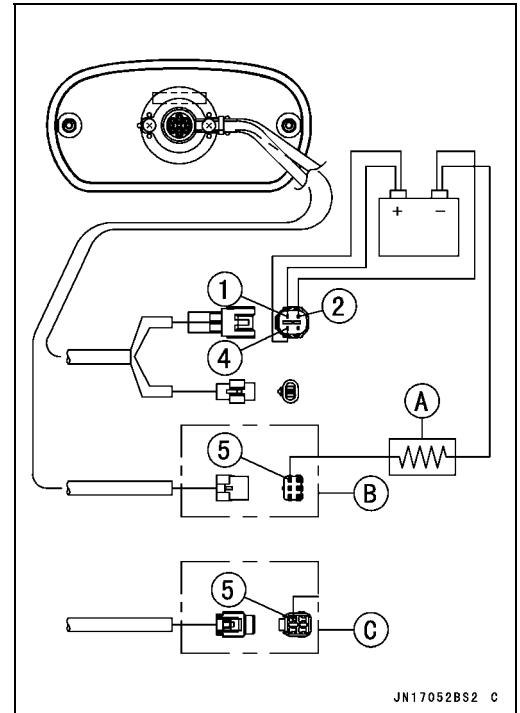
Speedometer Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Inspection”.
- The speed equivalent to the input frequency is indicated in the oscillator [A] if the square wave (illustrated as shown) would be input into the terminal [8].

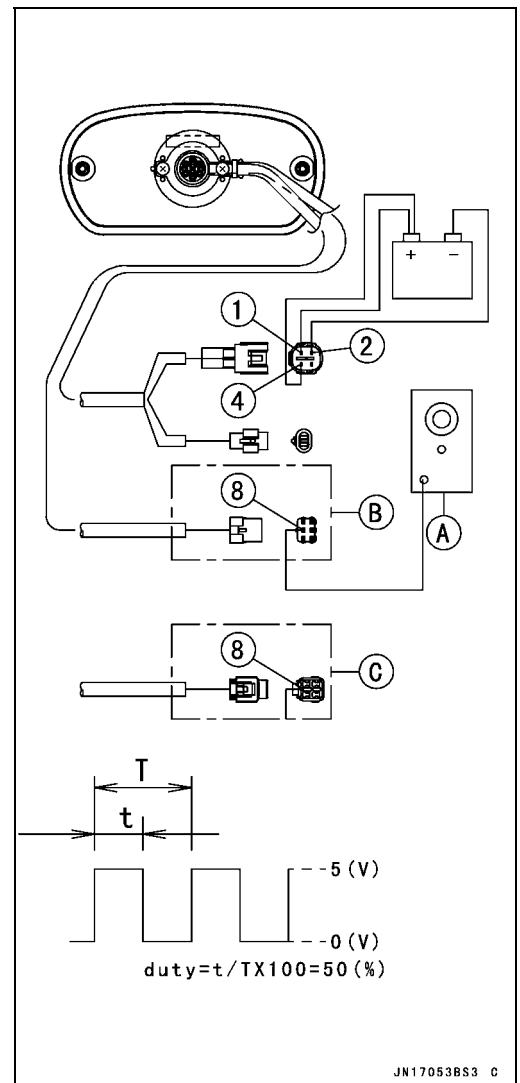
JT1500-A2 model ~ [B]

JT1500-A1 model [C]

- Indicates approximately 60 mph in case the input frequency would be approximately 265 Hz.
- Indicates approximately 60 km/h in case the input frequency would be approximately 165 Hz.



JN17052BS2 C



JN17053BS3 C

14-60 ELECTRICAL SYSTEM

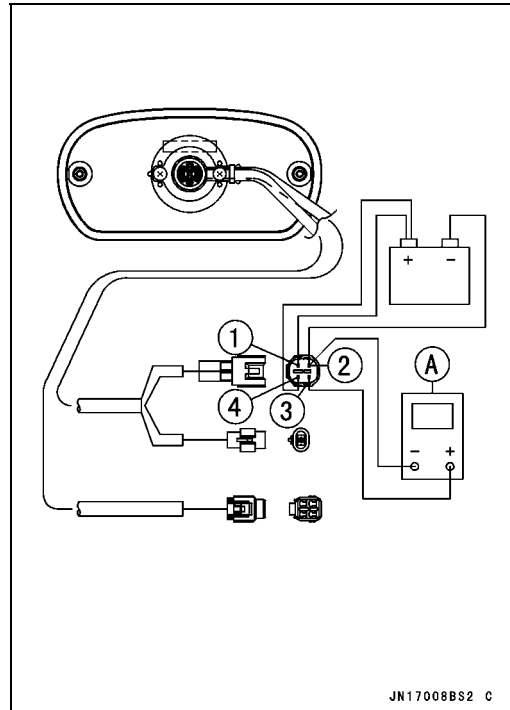
Multifunction Meter

- If the oscillator is not available, the speedometer can be checked as follows.
 - Install the meter unit.
 - Turn on the ignition switch.
 - Rotate the waterwheel by hand.
 - Check that the speedometer shows the speed.
- ★ If the speedometer does not work, check the speed sensor electric source voltage and speed sensor.



Speed Sensor Electric Source Inspection

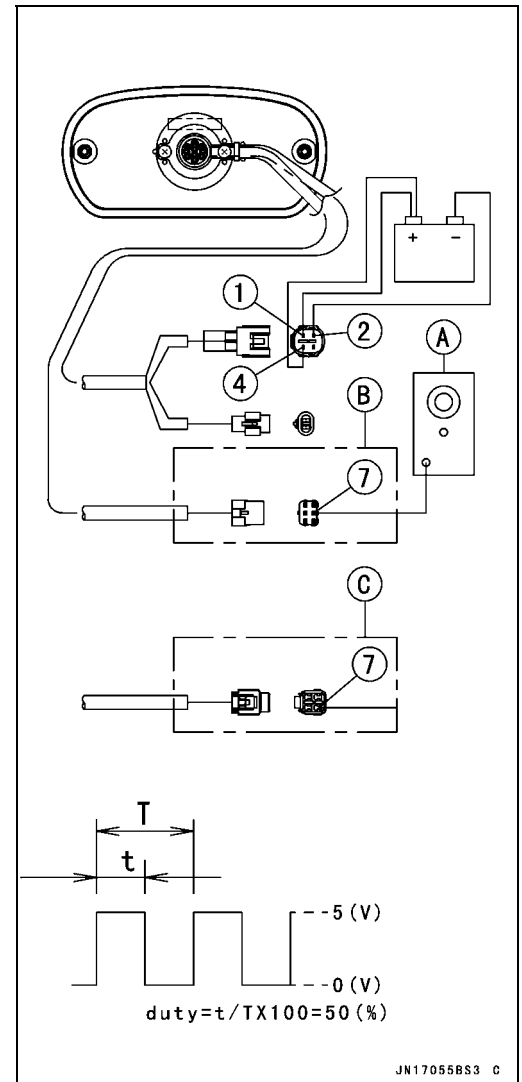
- Connect the 12 V battery and terminals in the same manner as specified in the "Display Function Inspection".
- Set the hand tester [A] to the DC 25 V range and connect it to the terminals [3] and [2].
- ★ If the voltage is less than 7 V, replace the meter assembly.



Multifunction Meter

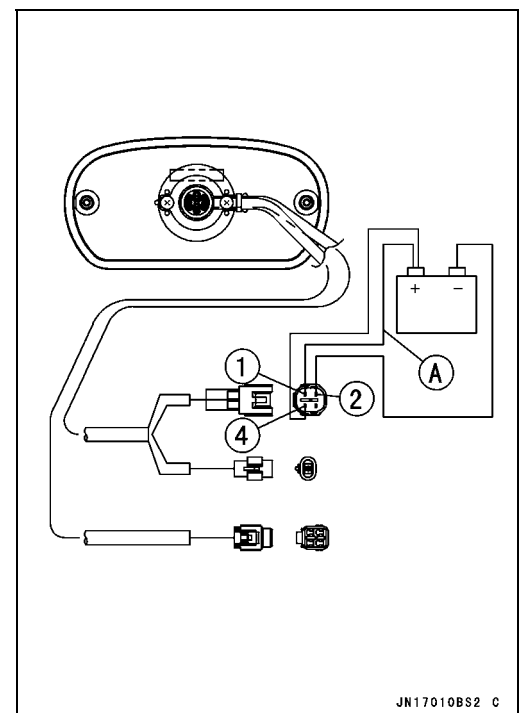
Tachometer Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Inspection”.
- The revolutions per minute (rpm) equivalent to the input frequency is indicated in the oscillator [A] if the square wave (illustrated as shown) would be input into the terminal [7].
 JT1500-A2 model ~ [B]
 JT1500-A1 model [C]
- The tachometer indicates approximately 3 000 r/min (rpm) in case the input frequency would be approximately 100 Hz.
- ★ If the tachometer does not work normally, replace the meter assembly.



Battery Symbol/bAt Characters/LED Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Inspection”.
- Check that the battery symbol/bAt characters/LED flash when the input voltage to the terminal [A] is lowered to 12 volts or less. And check that the meter returns in the state of normality when the input voltage to the black lead terminal is raised to 12.5 V or more.
- ★ If any display function does not work, replace meter assembly.



Multifunction Meter

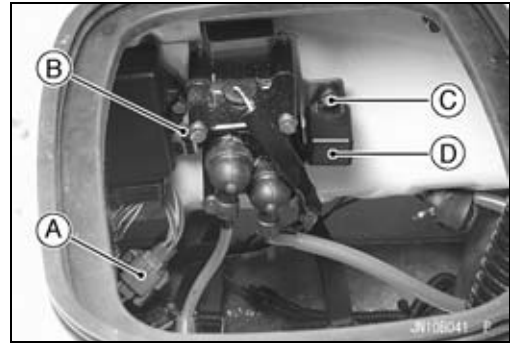
3. Buzzer
4. Multifunction Meter
5. Speed Sensor
6. 20 A Main Fuse
7. Joint Connector R
8. Starter Motor
9. Battery
10. Joint Connector P
11. Ignition Switch
12. ECU (Electronic Control Unit)
A: JT1500-A2 model ~

14-64 ELECTRICAL SYSTEM

Relay Assembly

Removal

- Remove the seat (see Hull/Engine Hood chapter).
- Remove the rear storage pocket.
- Remove:
 - Relay Assembly Connector [A]
 - Clamp [B]
 - Bolt [C]
 - Relay Assembly [D]



Installation

- Apply a non-permanent locking agent to the relay assembly mounting bolt and tighten it securely.
- Route the relay assembly leads correctly (see Cable, Wire and Harness Routing in Appendix chapter).

Circuit Inspection

- Remove the relay assembly.
- Check conductivity of the following numbered terminals by connecting the hand tester and one 12 V battery to the relay assembly as shown.
- ★ If the tester does not read as specified, replace the relay assembly.

Relay Assembly

Relay Assembly Circuit Inspection (with the battery disconnected)

	Tester Connection	Tester Reading (Ω)
ECU Main Relay [A]	3-4	∞
	1-2	Not ∞^*
Fuel Pump Relay [B]	7-8	∞
	5-6	Not ∞^*

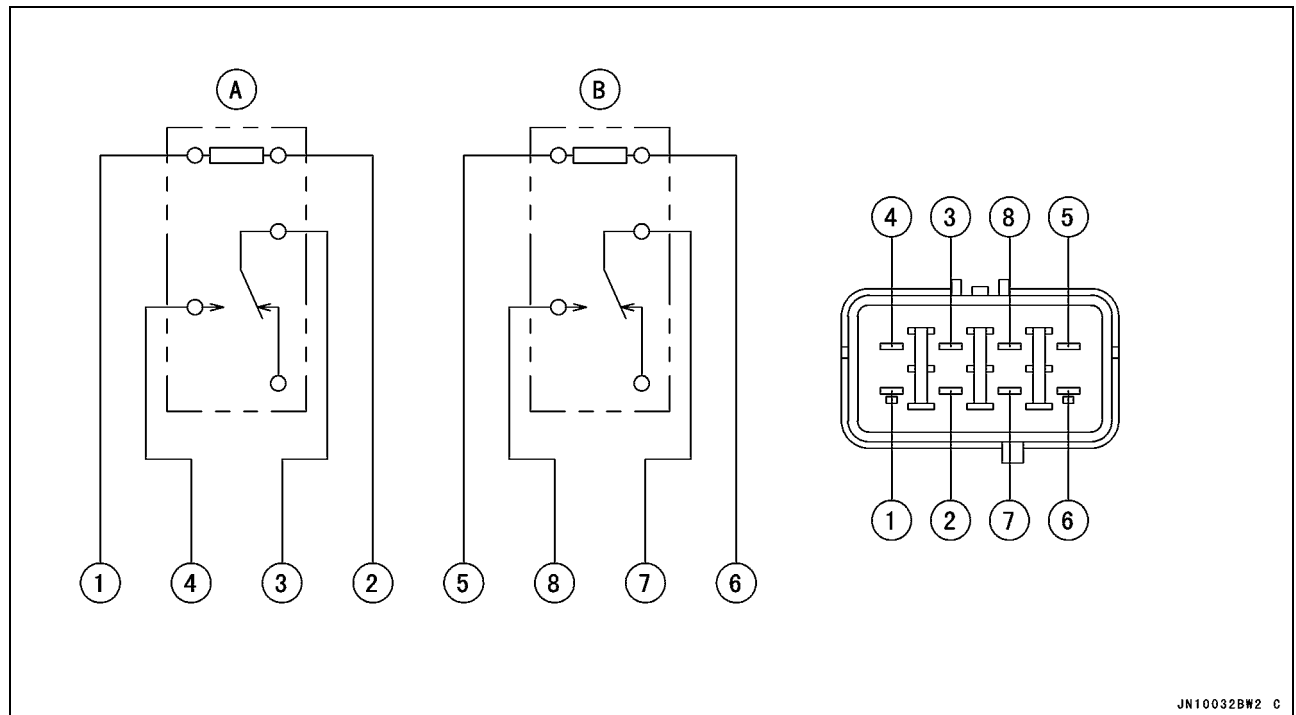
(*): The actual reading varies with the hand tester used.

Relay Assembly Circuit Inspection (with the battery connected)

	Battery Connection (+) (-)	Tester Connection	Tester Reading (Ω)
ECU Main Relay [A]	1-2	3-4	0
Fuel Pump Relay [B]	5-6	7-8	0

(+): Apply positive lead.

(-): Apply negative lead.



14-66 ELECTRICAL SYSTEM

Switches

Switch Inspection

- Using a hand tester, check to see that only the connections shown in the table have continuity (about zero ohms).
- For the switch housing and the ignition switch, refer to the tables in the Wiring Diagram.
- ★ If the switch has an open or short, repair it or replace it with a new one.

Special Tool - Hand Tester: 57001-1394

Ignition Switch

	R	R/W	BK/W	W
ON	○ ————— ○			
OFF			○ ————— ○	

Start Switch

	Y/R	Y/R
PUSH	○ ————— ○	

Stop Switch

	BK	W
FREE		
PUSH	○ ————— ○	

Tether Switch

TETHER CORD	BK	W	R/PU	Y/R
SET			○ ————— ○	
PULL	○ ————— ○			

Engine Oil Pressure Switch Connections*

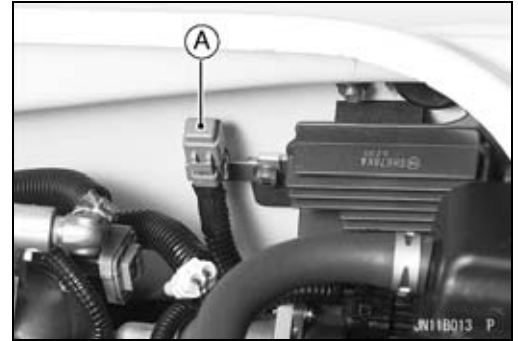
	SW. Terminal	
When engine is stopped	○ ————— ○	
When engine is running		

*: Engine lubrication system is in good condition

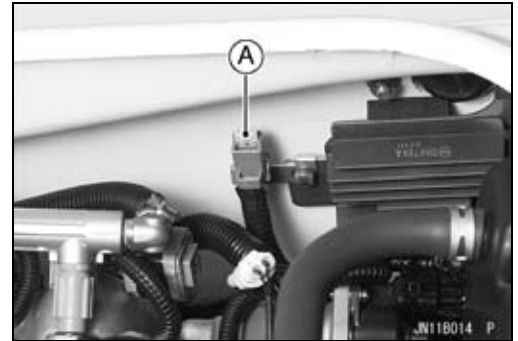
Fuse

Inspection

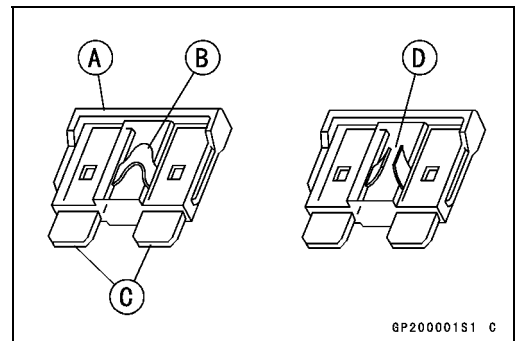
- Remove:
 - Seat
 - Fuse Case [A]



- Take out the fuse [A].



- Inspect the fuse element.
- ★ If it blown out, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.
- Housing [A]
- Fuse Element [B]
- Terminals [C]
- Blown Element [D]



CAUTION

When replacing a fuse, be sure the new fuse matches the specified fuse rating for that circuit. Installation of a fuse with a higher rating may cause damage to wiring and components.

Storage

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Lubrication	15-6
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15-2 STORAGE

Preparation for Storage

During the winter, or whenever the watercraft will not be in use for a long period of time, proper storage is essential. It consists of checking and replacing missing or worn parts; lubricating parts to ensure that they do not become rusted; and, in general, preparing the watercraft so that when the time comes to use it again, it will be in top condition.

NOTE

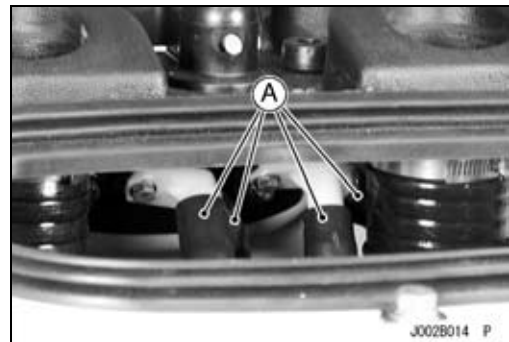
○ *Personal watercraft is not meant to be left in the water for extended periods. Continuous exposure to water over a long period of time will cause the hull paint to bubble and peel. It also causes electrolytic erosion of the metal parts of the pump, decreasing its service life. Larger boats which are left in the water must be hauled out periodically, so the bottom of the hull can be scraped and repainted with anti-fouling paint. They also usually have a sacrificial anode to reduce electrolytic erosion of metal parts in contact with the water.*

Cooling System

- Clean the cooling system (see the Periodic Maintenance chapter).

Bilge System

- Clean the bilge system (see the Periodic Maintenance chapter). Before reconnecting the hoses to the plastic breather fitting, blow air through both hoses [A] to force all water out of the bilge system.



Engine Oil

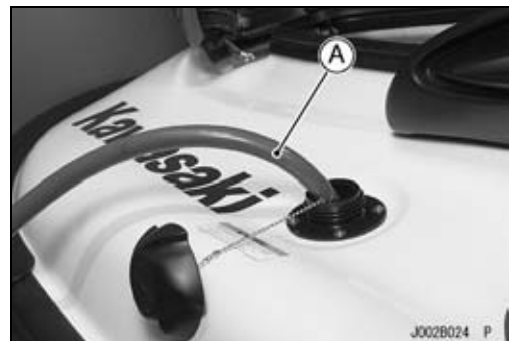
- Change the engine oil (see Engine Lubrication System in Periodic Maintenance chapter).

Fuel System

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

- Drain the fuel tank. This should be done with a siphon or pump.
[A] Siphon Hose



NOTE

○ *Lift the stern upward a little so that fuel and water in the bottom of the fuel tank may flow toward the fuel filter to completely drain the fuel tank.*

Preparation for Storage

- Remove the fuel pump (see the Fuel System chapter).
- Clean the fuel pump screen [A] (see Fuel System in Periodic Maintenance chapter).
- Refill the fuel tank with fresh fuel approximately 10 L (2.6 gal U.S.).
- Turn the ignition switch on.
- Push the lanyard key under the stop button, and start the engine and run it in 15 second periods until all fuel in the fuel system is with fresh fuel. Wait 5 minutes between 15 seconds running periods.

CAUTION

Do not run the engine without cooling water supply for more than 15 seconds at a time or severe engine and exhaust system damage will occur.

- Pull the lanyard key off the stop button and turn the ignition switch off.
- Drain the fuel tank.
- Leave the fuel filler cap loose to prevent condensation in the tank.

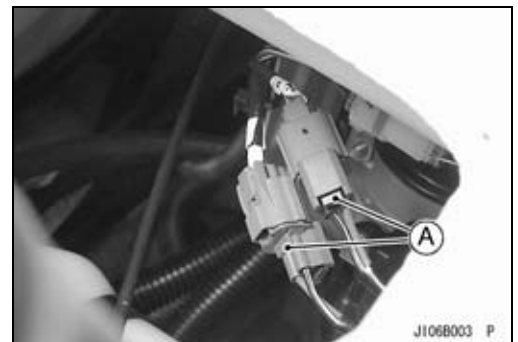
Engine

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect both two connection on the ignition coil primary lead connectors [A].
- Remove the spark plugs (see Electrical System in Periodic Maintenance chapter).
- Spray fogging oil directly into each cylinder.
- Turn the ignition switch on.
- Push the lanyard key under the stop button. Turn the engine over several times with the start button to coat the cylinder walls with oil.

⚠ WARNING

Do not lean over the engine when performing this procedure. An air/oil mist may be forcibly ejected from the spark plug holes and could get into your eyes. If you do get some in your eyes, wash your eyes immediately with liberal amounts of clean, fresh water. Consult a physician as soon as possible.

- Pull the lanyard key off the stop button and turn the ignition switch off.
- Spray the spark plugs with fogging oil, and reinstall the spark plugs and caps (see Electrical System in Periodic Maintenance chapter).



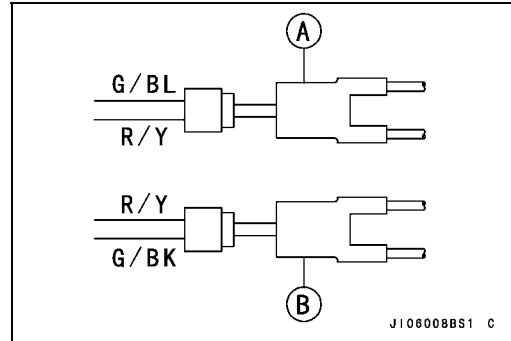
15-4 STORAGE

Preparation for Storage

- Reconnect the primary ignition coil lead connectors, noting the #1, #4 [A] and the #2, #3 [B] coil connectors. The #1, #4 coil connector has a red/yellow and a green/blue leads from the main harness. The #2, #3 coil connector has a red/yellow and green/black leads from the main harness.

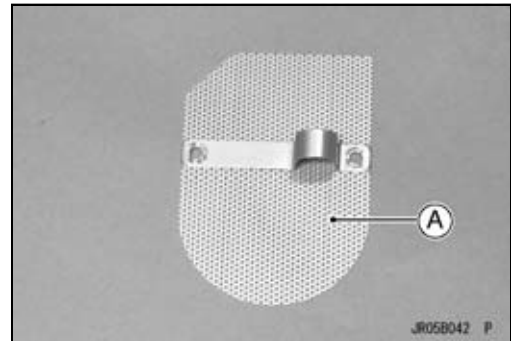
NOTE

○The service codes (COIL1 and COIL2) caused by this procedure are stored in the ECU. If necessary, these service codes can be erased by using the Kawasaki Diagnostic System (KDS).



Air Filter

- Remove the air filter (see Fuel (DFI) System chapter).
- Disassemble the air filter (see Fuel (DFI) System chapter).
- Wash and dry the flame arrester [A].
- Assemble and install the air filter (see Fuel (DFI) System chapter).



Battery

- Give a refresh charge before you store the watercraft and store it with the negative lead removed. Give a refresh charge once a month during storage.
- Remove the battery (see Electrical System in Periodic Maintenance chapter).
- Clean the exterior with a solution of baking soda and water (one heaping tablespoon of baking soda in one cup of water). Rinse thoroughly with water.

CAUTION

Do not allow any soda solution to enter the battery.

- Coat both battery terminals with grease.
- Store the battery in a cool, dry place. Do not expose it to freezing temperatures.

Engine Mounting Bolts

- Torque all engine mounting bolts (see Engine Removal/Installation chapter).

Torque - Engine Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)

Lubrication

- Carry out all recommended lubrication procedures (see Lubrication in Periodic Maintenance chapter).

Preparation for Storage

General

- Wash the engine compartment with fresh water and remove the drain screw in the stern to drain the water. Wipe up any water left in the compartment.

CAUTION

Use only a mild detergent in water to wash the hull. Harsh solvents may attack the surface or smear the colors.
--

- Apply a good grade of wax to all exterior hull surfaces.
- Lightly spray all exposed metal parts with a penetrating rust inhibitor.
- Remove the seat, or block the seat up with 10 mm (0.39 in.) spacers to insure adequate ventilation, and prevent corrosion.
- Cover the watercraft and store it in a clean, dry place.

15-6 STORAGE

Removal from Storage

Lubrication

- Carry out all recommended lubrication procedures (see the Periodic Maintenance chapter).

General Inspection

- Check for binding or sticking throttle, steering or shift mechanism. The throttle lever must return fully when released.
- Clean and gap spark plugs (see Electrical System in Periodic Maintenance chapter).
- Check all rubber hoses for weathering a cracking, or looseness.
- Check that the drain screw in the stern is securely tightened.
- Check the fire extinguisher for a full charge.
- Check the battery, charge if necessary, and clean the terminals. Install the battery (see Battery Installation in Electrical System chapter).

Fuel System

- Check and clean or replace the fuel pump screens as necessary (see Fuel System in Periodic Maintenance chapter).

WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from source of flame or spark; this includes any appliance with a pilot light.

- After refueling and before starting the engine, tilt the seat to the rear for several minutes to ventilate the engine compartment.

WARNING

A concentration of gasoline fumes in the engine compartment can cause a fire or explosion.

- Check for fuel leaks. Repair if necessary.
- Check the engine oil level. Fill the oil with the specified oil.

Removal from Storage

*Test Run***⚠ WARNING**

Do not run the engine in a closed area. Exhaust gases contain carbon monoxide, a colorless, odorless, poisonous gas. Breathing exhaust gas leads to carbon monoxide poisoning, asphyxiation, and death.

- Start the engine and run it only for 15 seconds. Check for fuel, oil and exhaust leaks. Any leaks must be repaired.

CAUTION

Do not run the engine without cooling water supply for more than 15 seconds at a time or severe engine and exhaust system damage will occur.

- Install the seat making sure it is locked.

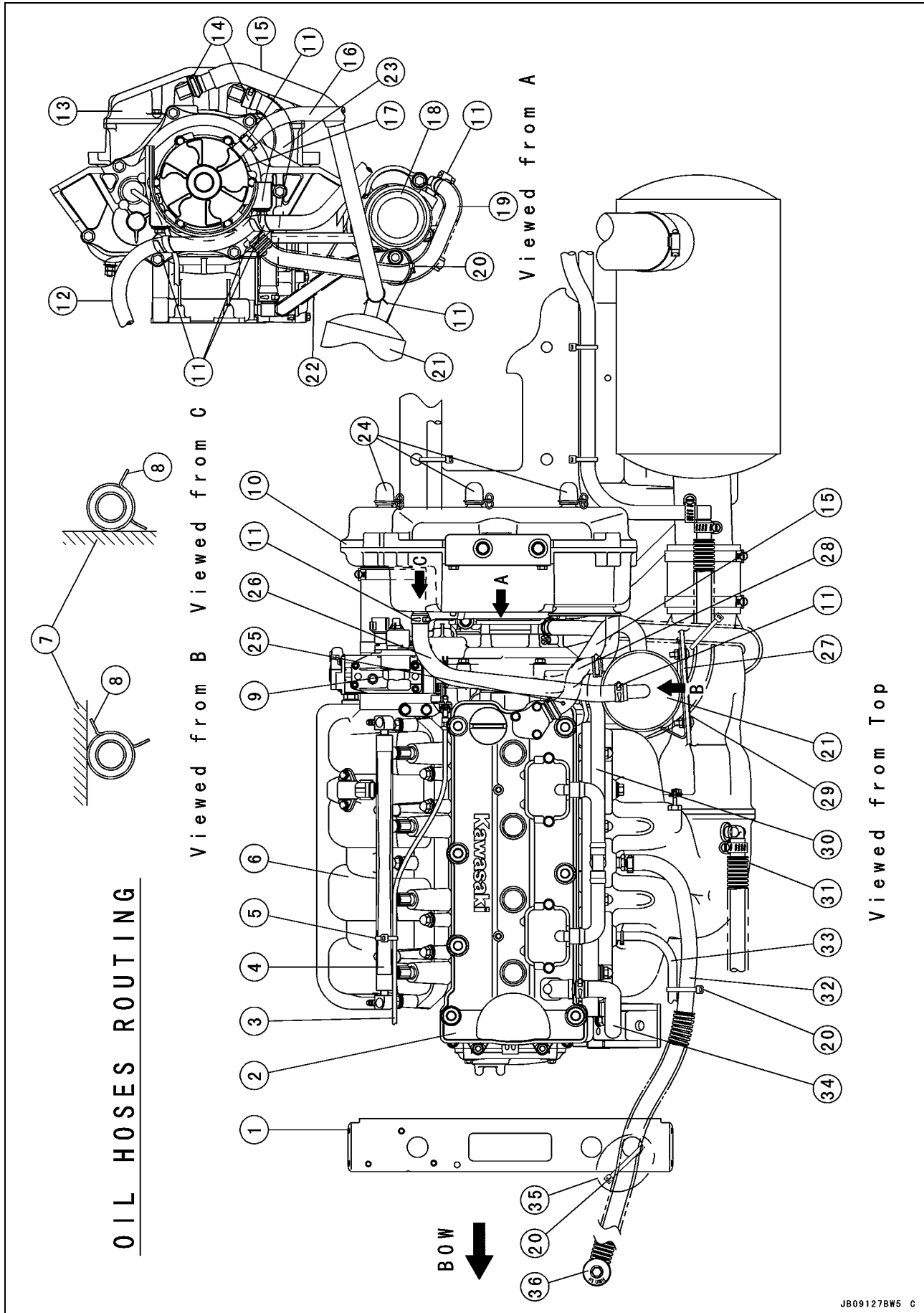
Appendix

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Cable, Wire and Hose Routing	16-2
Troubleshooting Guide	16-32

16-2 APPENDIX

Cable, Wire and Hose Routing



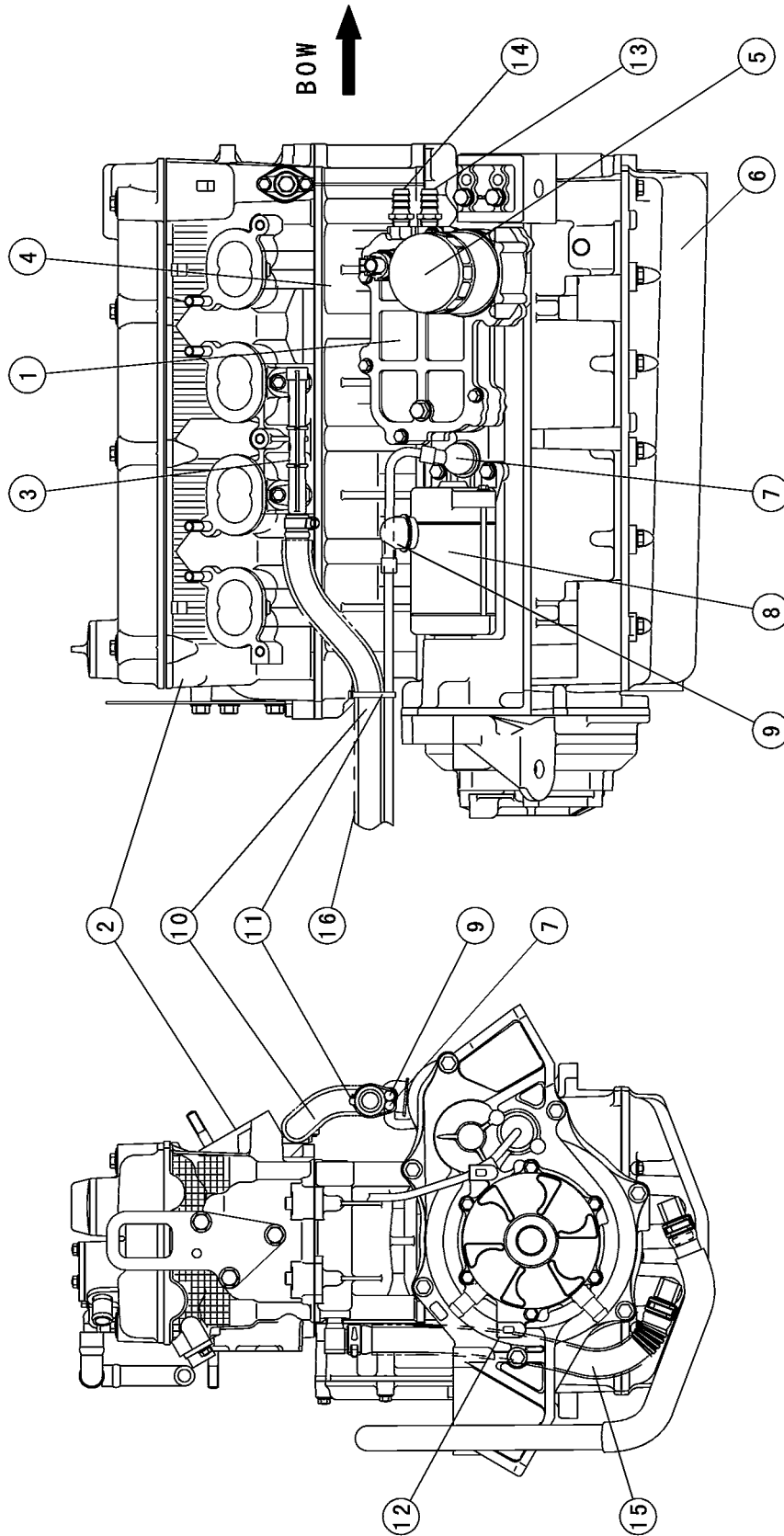
Cable, Wire and Hose Routing

1. Crossmember
2. Cylinder Head Cover
3. Throttle Cable
4. Delivery Pipe
5. Fix the throttle cable to the delivery pipe with the band.
6. Inlet Manifold
7. Horizontal Plane
8. Position the clamp pinch head below the horizontal plane.
9. Throttle Body Assy
10. Air Filter
11. Clamp
12. Cooling Hose (Cylinder ~ Left Water Box Muffler)
13. Oil Pan
14. Position the clamp pinch head as shown.
15. Oil Separator Tank Hose (Tank ~ Oil Pan)
16. Cooling Hose (Pump ~ Output Cover)
17. Output Cover
18. Exhaust Pipe
19. Cooling Hose (Output Cover ~ Exhaust Pipe)
20. Band
21. Oil Separator Tank
22. Cooling Hose (Left Water Box Muffler ~ Cylinder)
23. Return Oil Hose (Cylinder ~ Oil Pan)
24. Air Filter Drain Cap
25. White Mark
26. Oil Separator Tank Hose (Tank ~ Air Filter)
27. Deck (Port Side)
28. Oil Separator Tank Hose (Cylinder Head Cover ~ Tank)
29. Plate
30. Air Suction Valve Hose
31. Exhaust Manifold
32. Flushing Hose
33. Bypass Outlet Hose
34. Breather Hose (Cylinder Head ~ Breather Case)
35. Run the flushing hose under the crossmember. Fix the flushing hose with the band at the left end hole so that the hose does not touch the crossmember.
36. Flushing Cap

16-4 APPENDIX

Cable, Wire and Hose Routing

OIL AND COOLING HOSES ROUTING



Viewed from Starboard Side

Viewed from Stern

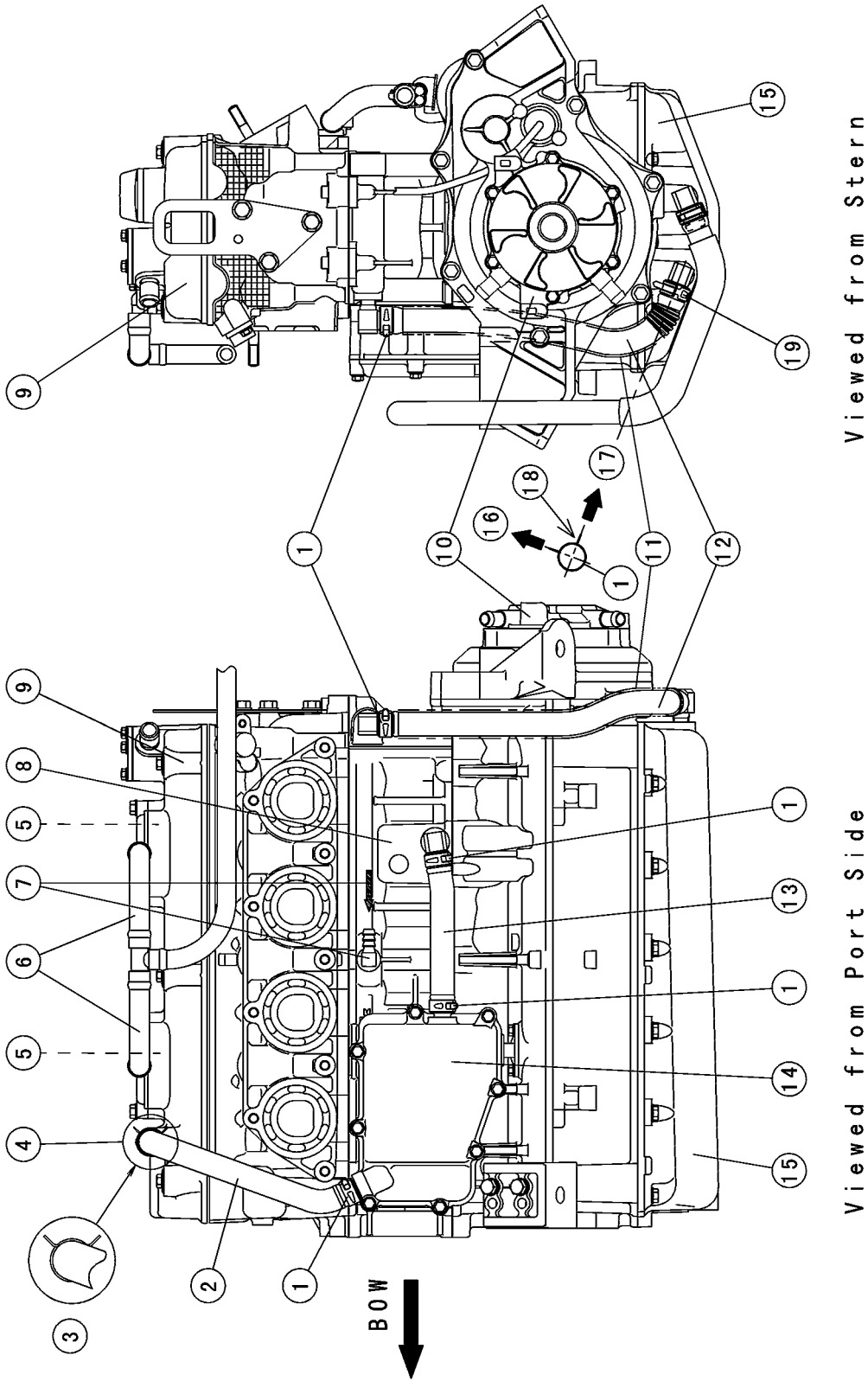
Cable, Wire and Hose Routing

1. Oil Cooler
2. Cylinder Head
3. Water Pipe
4. Cylinder
5. Oil Filter
6. Oil Pan
7. Battery (-) Cable
8. Starter Motor
9. Starter Motor Cable
10. Cooling Hose (Cylinder Head ~ Left Water Box Muffler)
11. Fix the No.10 cooling hose, battery (-) cable and starter motor cable with the band.
12. Output Cover
13. Water Hose Joint (Inlet)
14. Water Hose joint (Outlet)
15. Return Oil Hose (Cylinder ~ Oil Pan)
16. Protective Tube

16-6 APPENDIX

Cable, Wire and Hose Routing

BREATHER AND COOLING HOSES ROUTING



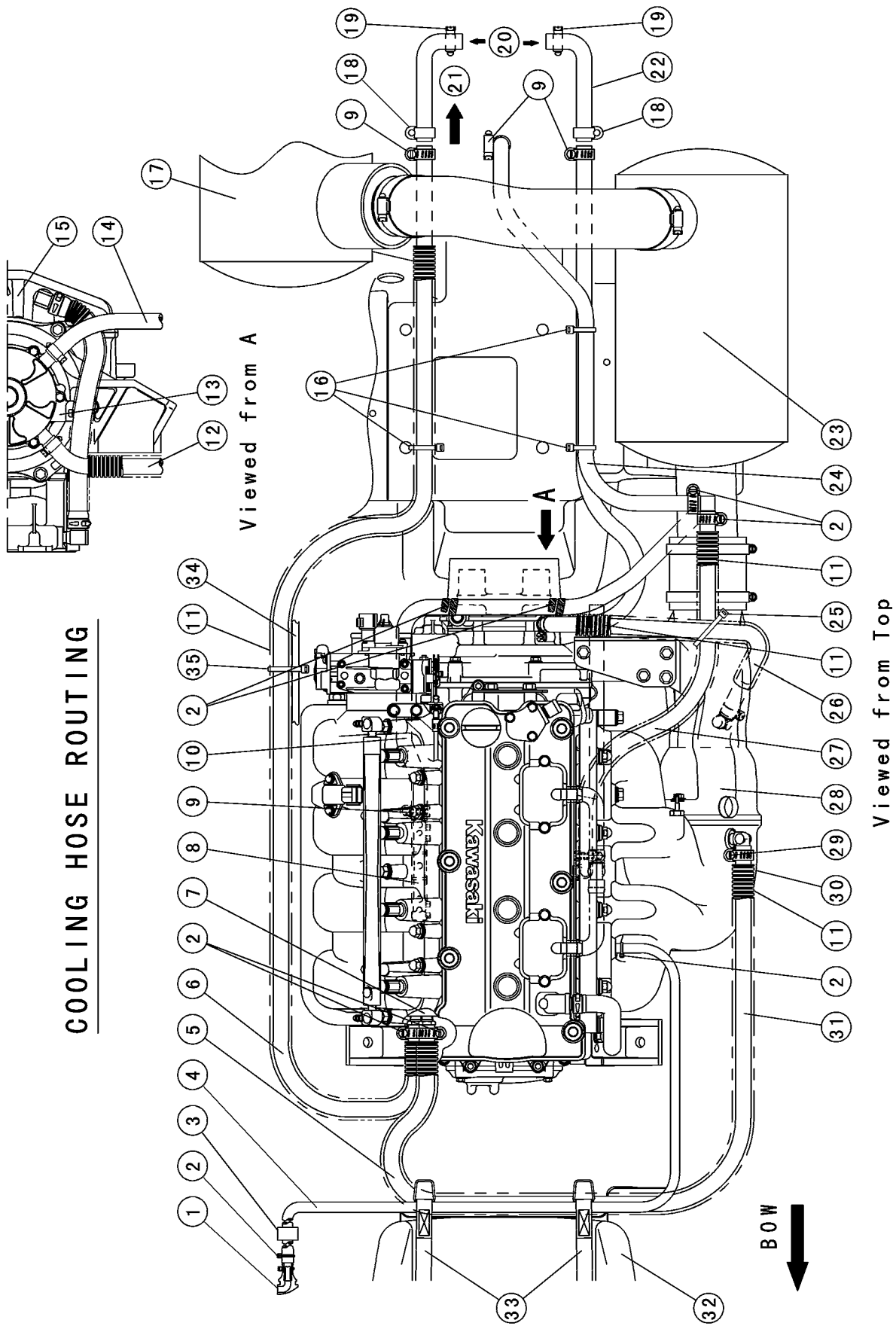
Cable, Wire and Hose Routing

1. Clamp
2. Breather Hose (Cylinder Head ~ Breather Case)
3. Clamp Detail
4. Position the clamp pinch heads as shown.
5. Air Suction Valve
6. Air Suction Valve Hose
7. Inlet Water Pipe Joint on the Cylinder (Cooling Water from Left Water Box Muffler)
8. Cylinder
9. Cylinder Head Cover
10. Output Cover
11. Protective Tube
12. Return Oil Hose (Cylinder ~ Oil Pan)
13. Breather Hose (Cylinder ~ Breather Case)
14. Breather Case
15. Oil Pan
16. Front Pinch Head
17. Rear Pinch Head
18. Position the clamp so that its pinch heads do not touch the oil separator tank hose.

16-8 APPENDIX

Cable, Wire and Hose Routing

COOLING HOSE ROUTING

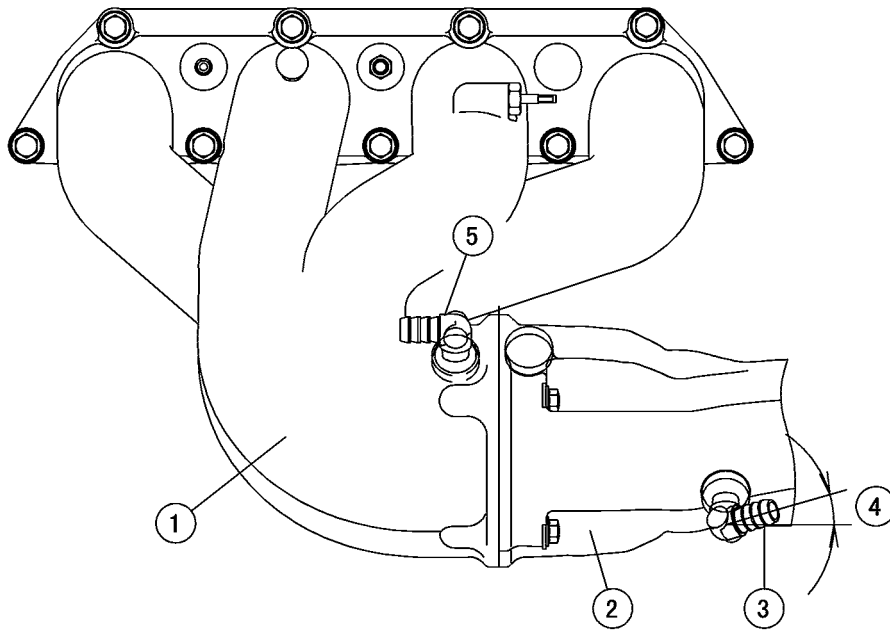


Cable, Wire and Hose Routing

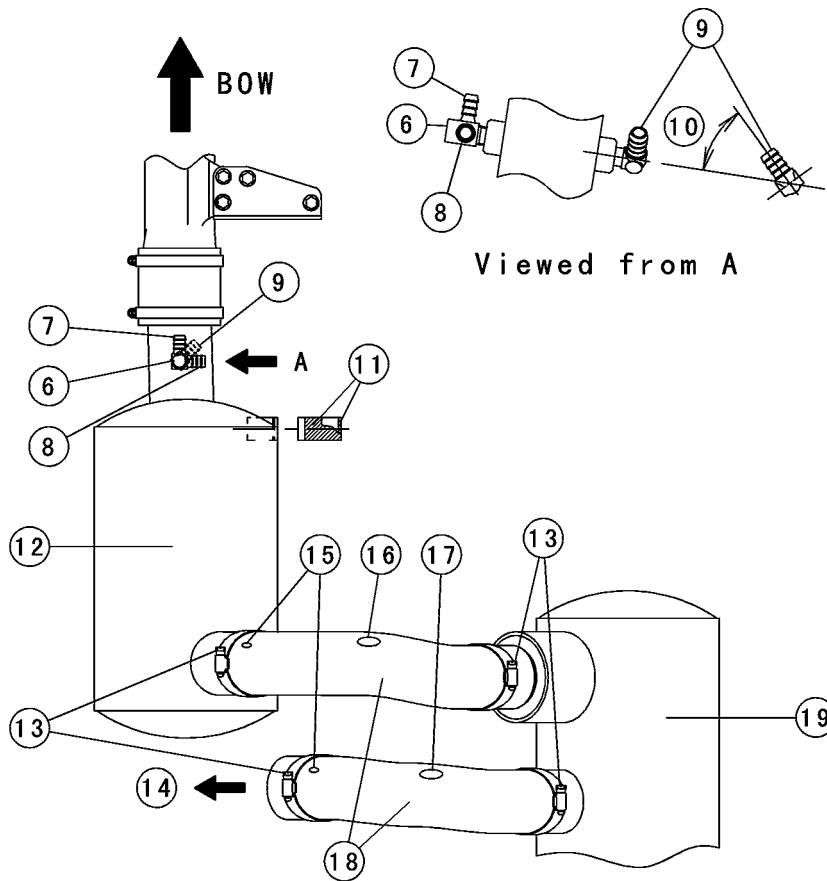
Refer to the Exploded View and Flow Diagram in the Cooling and Bilge Systems chapter. Install the clamp as shown, noting its screw head direction.

1. Bypass Outlet
2. Clamp
3. Holder
4. Bypass Outlet Hose: Run the bypass outlet hose between the fuel tank and the straps as shown.
5. Cooling Hose (Oil Cooler ~ Exhaust Manifold): Run the cooling hose between the fuel tank and the straps as shown.
6. Cooling Hose (Pump ~ Oil Cooler)
7. Oil Cooler
8. Water Pipe on the Cylinder Head
9. Position the clamp screw head as shown.
10. Cooling Hose (Cylinder Head ~ Water Pipe Joint under the Left Water Box Muffler)
11. Protective Tube
12. Cooling Hose (Output Cover ~ Exhaust Pipe)
13. Output Cover
14. Cooling Hose (Pump ~ Output Cover)
15. Oil Pan
16. Band
17. Right Water Box Muffler
18. Position the clamp so that its screw head faces downward and outside.
19. Position the clamp so that its screw head faces backward.
20. Pump
21. Drain
22. Cooling Hose (Pump ~ Output Cover)
23. Left Water Box Muffler
24. Cooling Hose (Left Water Box Muffler ~ Hull)
25. Fix the No.26 and No.27 cooling hoses with the band.
26. Cooling Hose (Output Cover ~ Exhaust Pipe)
27. Cooling hose (left water box muffler ~ cylinder): Run the No.27 cooling hose under the No.26 cooling hose as shown.
28. Exhaust Pipe
29. Position the clamp so that its screw head faces inside.
30. Exhaust Manifold
31. Cooling Hose (Oil Cooler ~ Exhaust Manifold)
32. Fuel Tank
33. Fuel Tank Strap
34. Shift Cable
35. Fix the No. 6 cooling hose and the shift cable with the band.

INSTALLING DIRECTION OF WATER HOSE JOINT



Viewed from Port Side



Viewed from Top

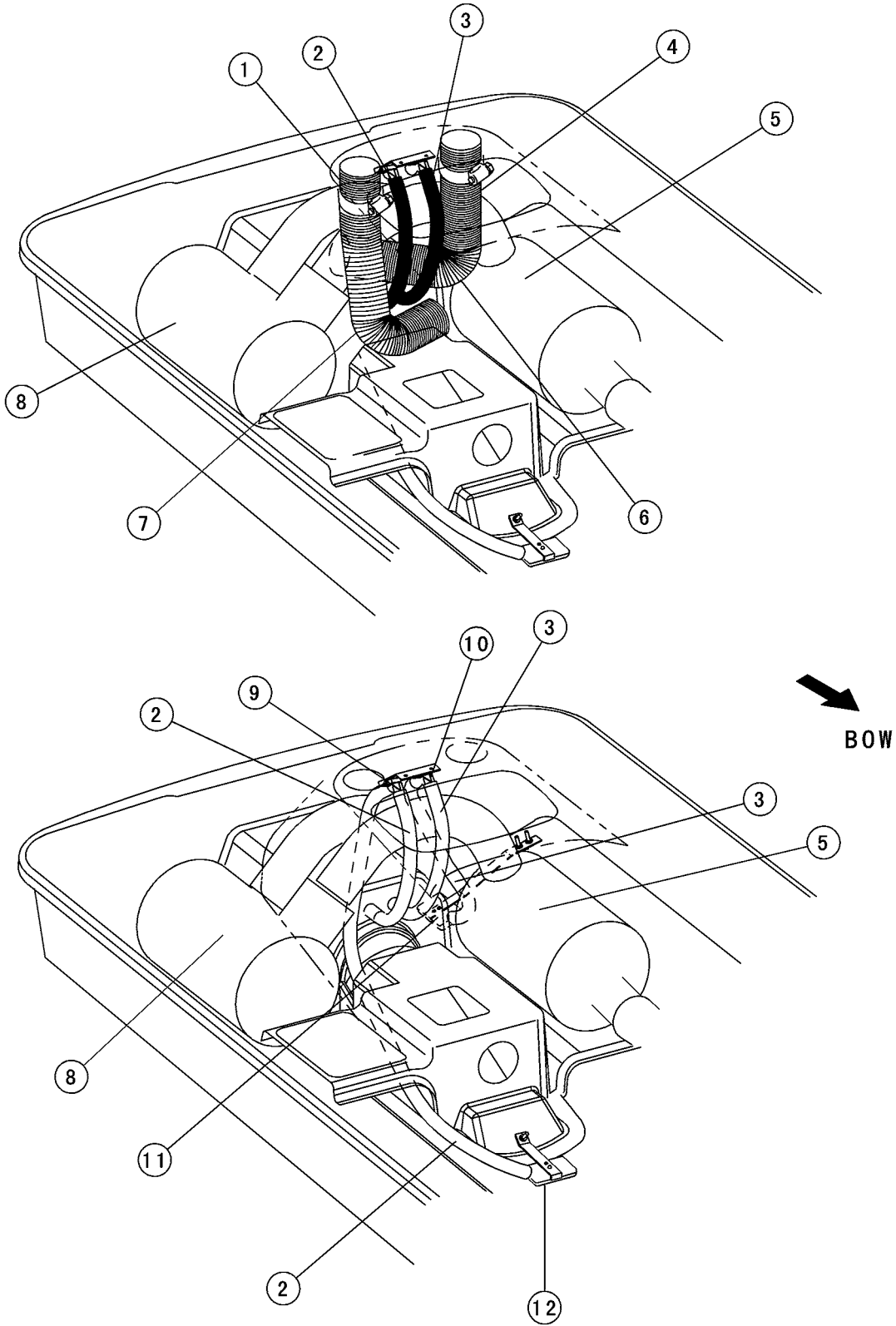
Cable, Wire and Hose Routing

1. Exhaust Manifold
2. Exhaust Pipe
3. Water Hose Point (Cooling Hose from the Output Cover)
4. 30°
5. Water Hose Joint (Cooling Hose from the Oil Cooler)
6. Upper Water Hose Joint
7. Cooling Hose Fitting (Left Water Box Muffler ~ Cylinder)
8. Cooling Hose Fitting (Left Water Box Muffler ~ Drain)
9. Lower Water Hose Joint
10. 45°
11. Dampers
12. Left Water Box Muffler
13. Position the clamp so that their screw heads face forward.
14. To Tail Pipe
15. White Marks
16. F Mark
17. R Mark
18. Exhaust Tubes
19. Right Water Box Muffler

16-12 APPENDIX

Cable, Wire and Hose Routing

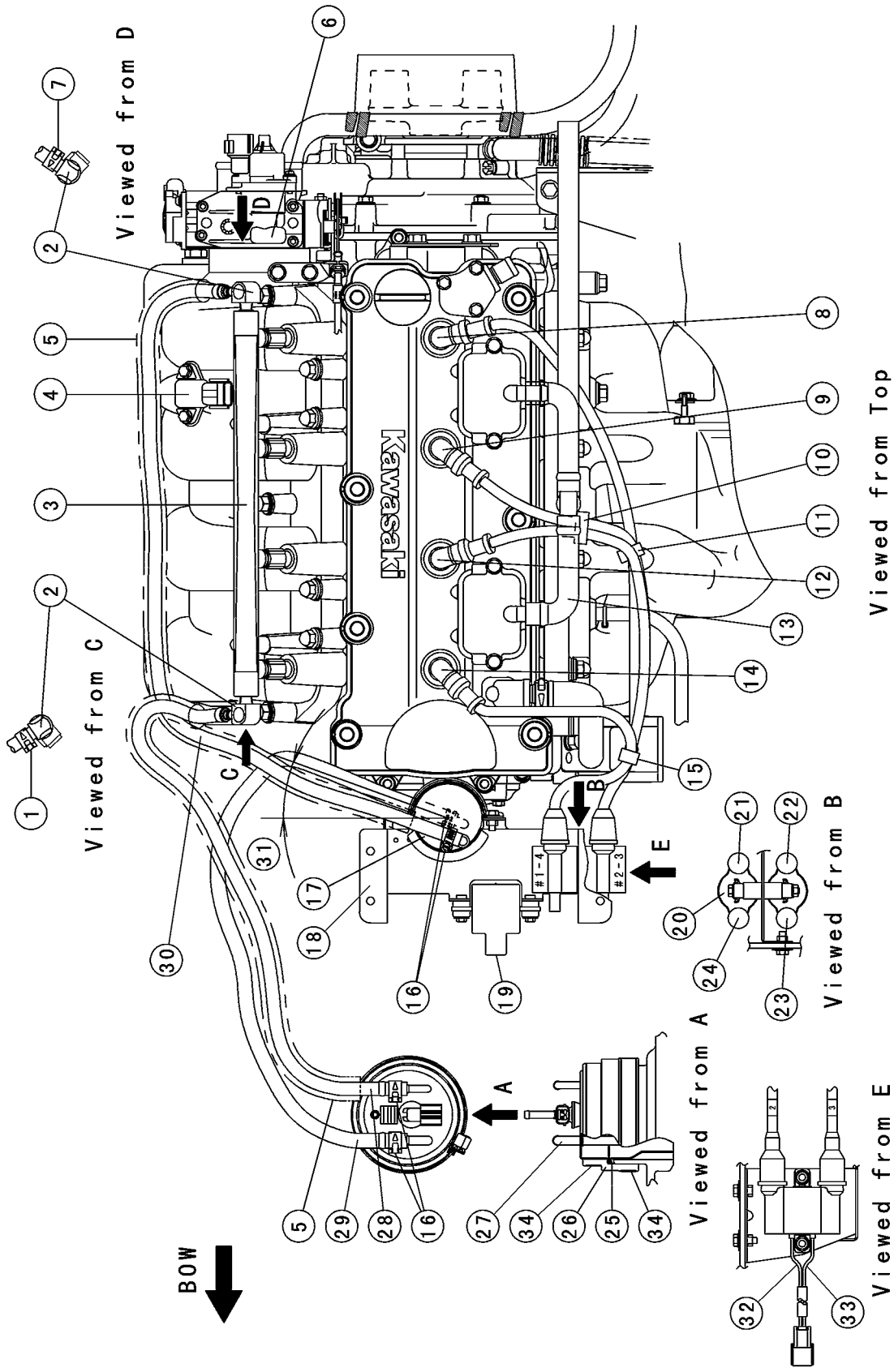
BILGE HOSE ROUTING



Cable, Wire and Hose Routing

1. Right Rear Duct
2. Right Bilge Hose
3. Left Bilge Hose
4. Left Rear Duct
5. Left Water Box Muffler
6. Position the left rear duct inside the left bilge hose as shown.
7. Position the right rear duct under the right bilge hose as shown.
8. Right Water Box Muffler
9. Right Bilge Breather
10. Left Bilge Breather
11. Left Bilge Filter
12. Right Bilge Filter

FUEL AND IGNITION SYSTEM ROUTING



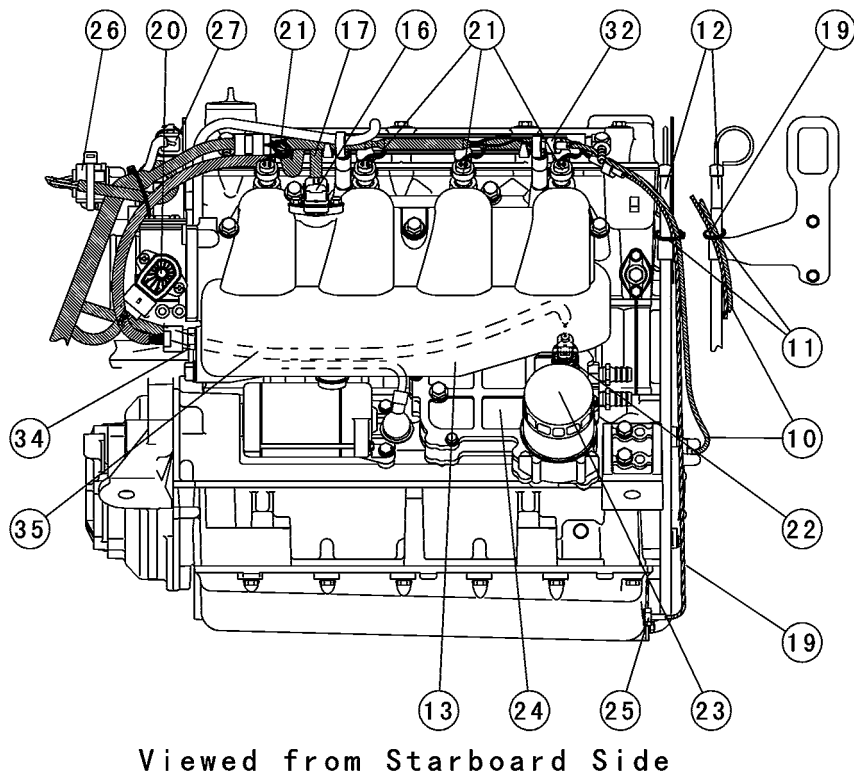
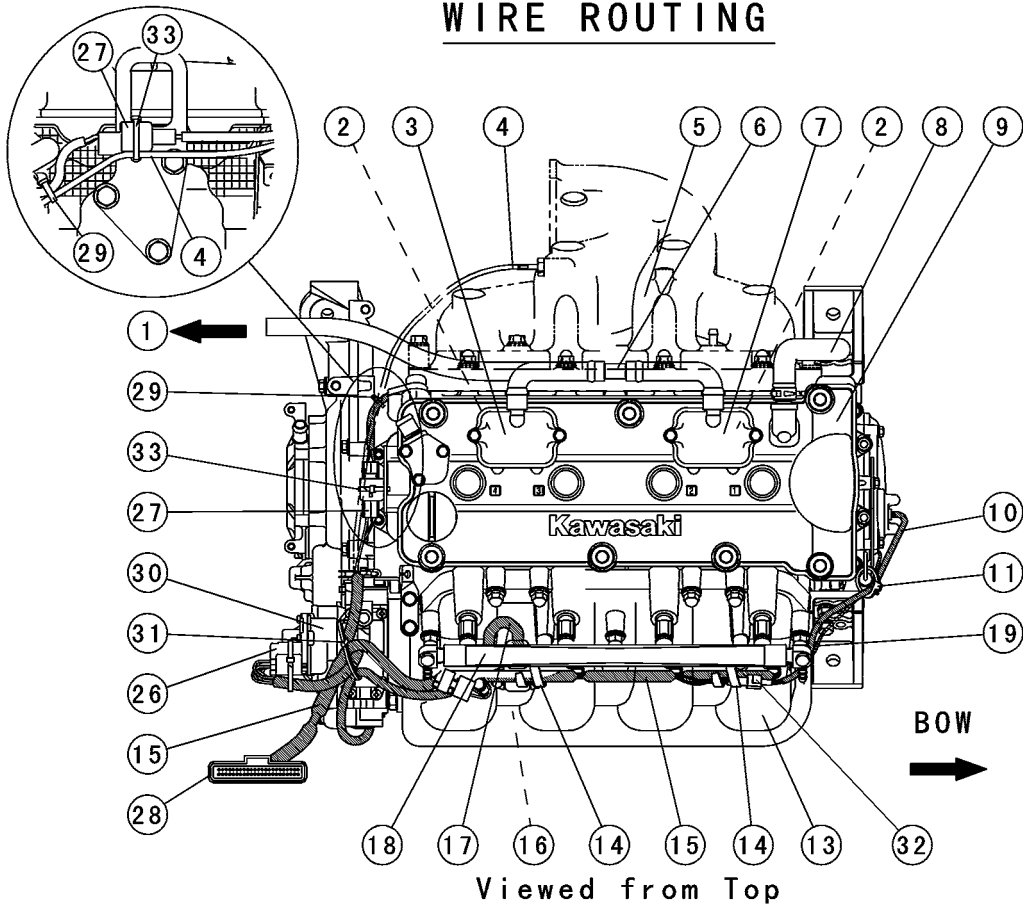
Cable, Wire and Hose Routing

1. Position the clamp screw so that its head faces forward (JT1500-A1).
Position the double spring clamp so that its pinch head faces forward (JT1500-A2 ~).
2. Delivery Pipe Joints
3. Delivery Pipe
4. Inlet Air Pressure Sensor
5. Protective Tube
6. Throttle Body Assy
7. Position the clamp screw so that its head faces backward (JT1500-A1).
Position the double spring clamp so that its pinch head faces backward (JT1500-A2 ~).
8. #4 Spark Plug Cap
9. #3 Spark Plug Cap
10. Fix the #2 and #3 spark plug leads with the clamp.
11. Fix the #3 and #4 spark plug leads with the clamp.
12. #2 Spark Plug Cap
13. Air Suction Valve Hose
14. #1 Spark Plug Cap
15. Fix the #1 and #2 spark plug leads with the clamp.
16. Clamp (JT1500-A1)
Double Spring Clamp (JT1500-A2 ~)
17. Fuel Filter
18. Bracket
19. Vehicle-down Sensor
20. Ignition Coils
21. #4 Spark Plug Lead
22. #3 Spark Plug Lead
23. #2 Spark Plug Lead
24. #1 Spark Plug Lead
25. O-ring
26. Holder
27. Fuel Pump
28. Return Fuel Hose
29. Main Fuel Hose
30. Supply Fuel Hose
31. 20°
32. Position the black/white lead upward (both ignition coils).
33. Position the red lead downward (both ignition coils).
34. Clamp

16-16 APPENDIX

Cable, Wire and Hose Routing

WIRE ROUTING



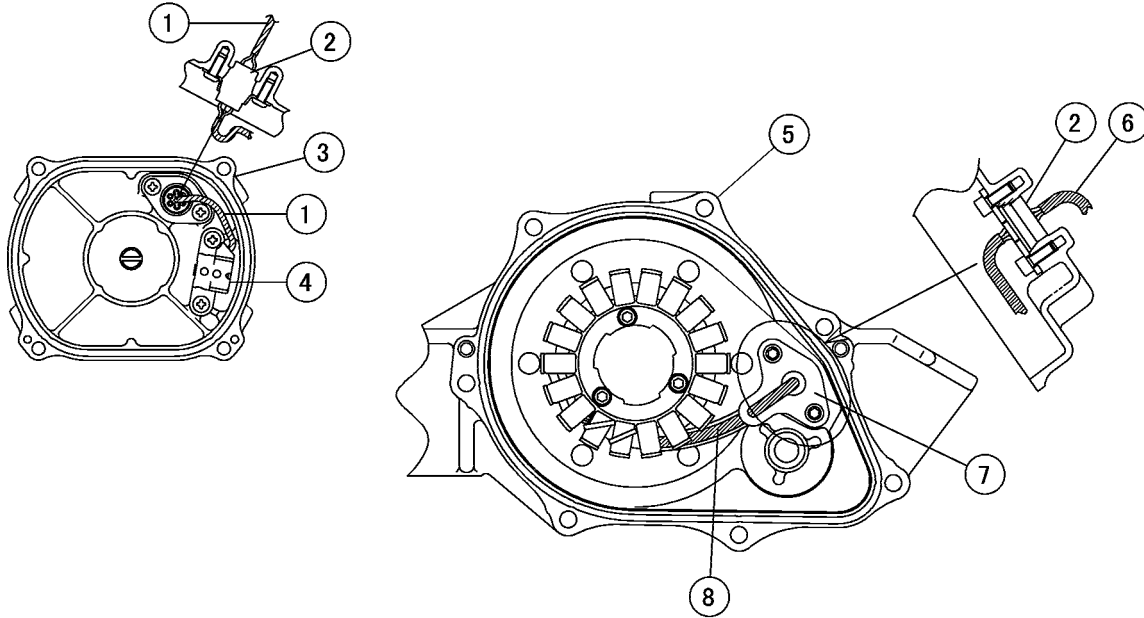
Cable, Wire and Hose Routing

1. Air Suction Valve Hose (to Air Filter)
2. Air Suction Valve
3. Air Suction Valve Cover (Rear)
4. Water Temperature Sensor Leads
5. Exhaust Manifold
6. Air Suction Valve Hose Fitting
7. Air Suction Valve Cover (Front)
8. Breather Hose
9. Cylinder Head Cover
10. Crankshaft Sensor Leads
11. Fix the crankshaft sensor leads and the oil temperature sensor leads to the dipstick pipe with the band.
12. Dipstick Pipe
13. Inlet Manifold
14. Clamp the engine harness and the crankshaft sensor lead connector.
15. Engine Harness
16. Inlet Air Pressure Sensor
17. Run the inlet air pressure sensor leads under the delivery pipe.
18. Delivery Pipe
19. Oil Temperature Sensor Leads
20. Throttle Sensor Connector
21. Injectors
22. Oil Pressure Switch
23. Oil Filter
24. Oil Cooler
25. Oil Temperature Sensor
26. ISC (Idle Speed Controller) Connector
27. Camshaft Position Sensor Connector
28. ECU (Electronic Control Unit) Connector
29. Clamp the water temperature sensor and camshaft position sensor leads.
30. ISC (Idle Speed Controller)
31. Fix the engine harness to the ISC with the band.
32. Crankshaft Sensor Lead Connector
33. Fix the camshaft position sensor connector and water temperature sensor leads with the band.
34. Inlet Air Temperature Sensor
35. Run the oil pressure switch lead between the cylinder and inlet manifold.

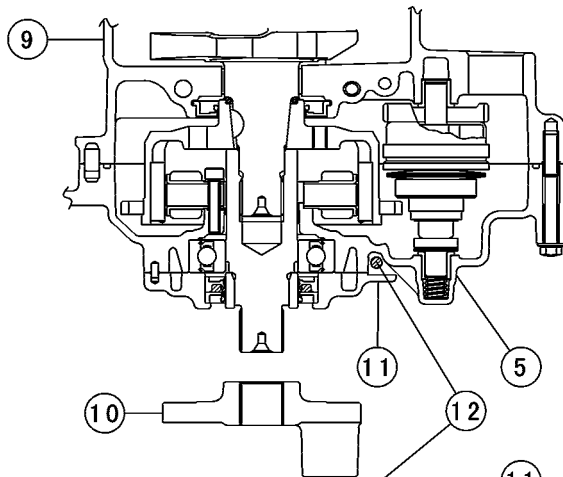
16-18 APPENDIX

Cable, Wire and Hose Routing

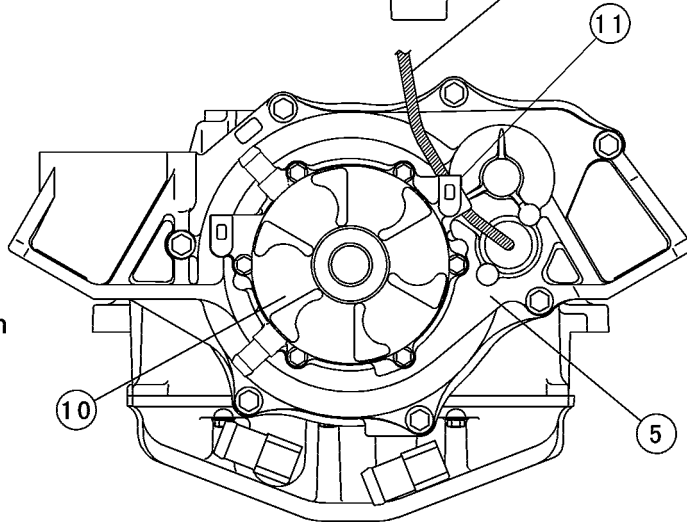
WIRE ROUTUNG AT CRANKSHAFT SENSOR AND MAGNETO COVER



Viewed from Top



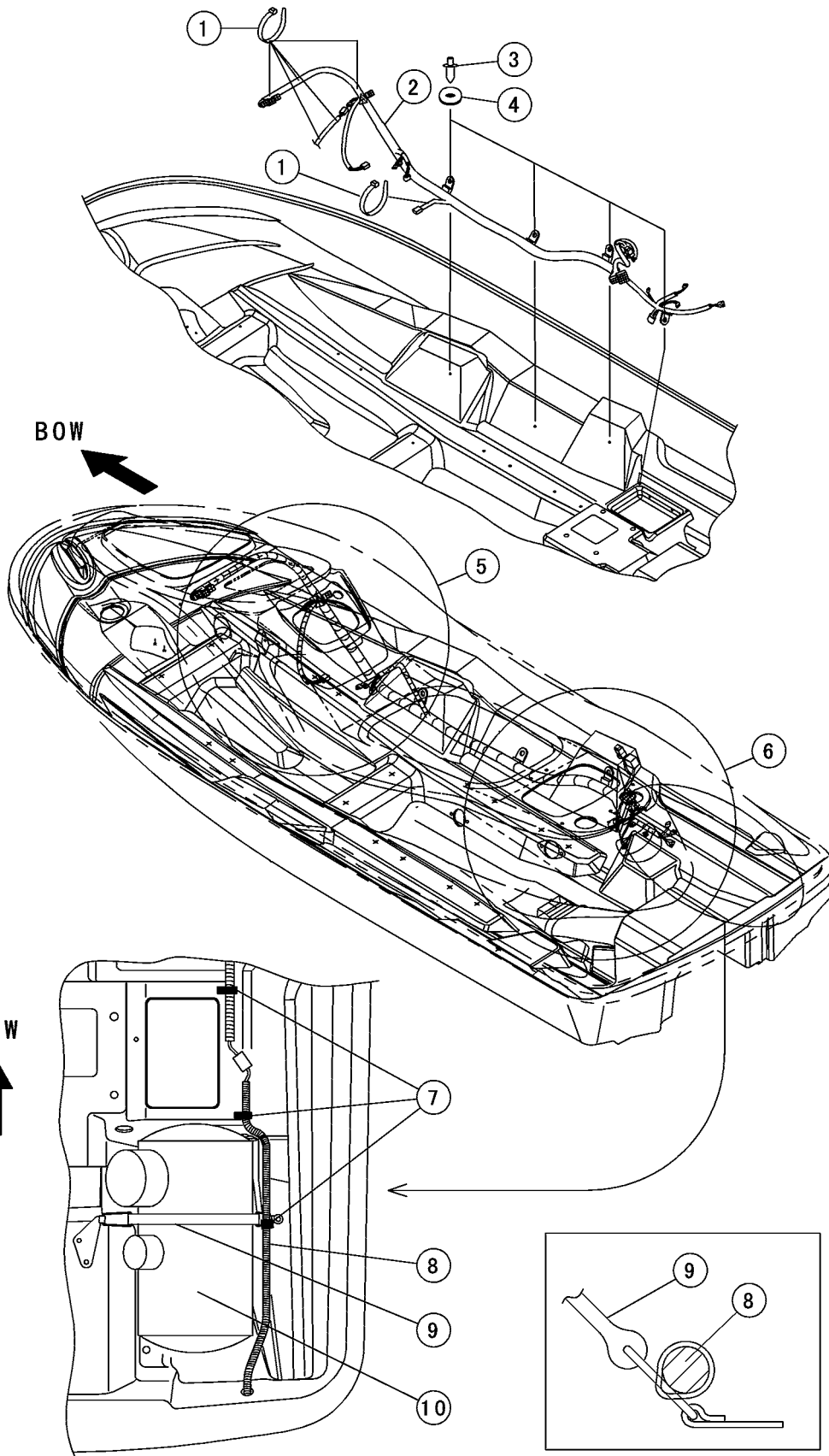
Viewed from Stern



Cable, Wire and Hose Routing

1. Crankshaft Sensor Leads
2. Grommet
3. Crankshaft Sensor Cover (Reverse Side)
4. Crankshaft Sensor
5. Magneto Cover (Reverse Side)
6. Magneto Leads
7. Plate for fixing the magneto leads: Do not place the leads between the plate and magneto cover.
8. Run the magneto leads along the hollow of the magneto cover.
9. Crankcase
10. Coupling
11. Output Cover
12. Run the magneto leads between the magneto cover and output cover. Do not pinch the leads.

MAIN HARNESS ROUTING

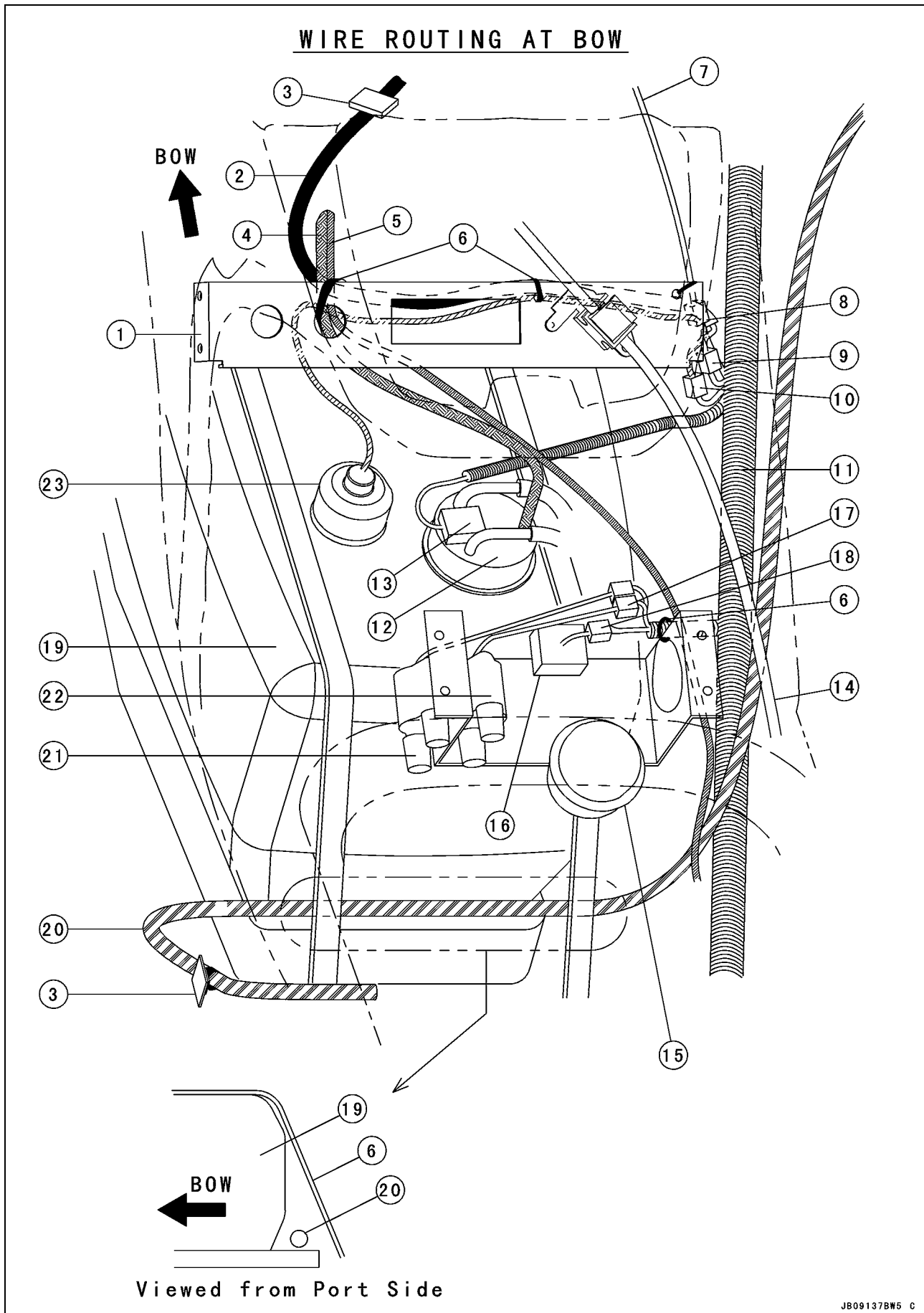


Cable, Wire and Hose Routing

1. Band
2. Main Harness
3. Rivet
4. Washer
5. See wire routing at bow.
6. See wire routing at stern.
7. Clamp
8. Speed Sensor Leads
9. Water Box Muffler Strap
10. Water Box Muffler

16-22 APPENDIX

Cable, Wire and Hose Routing



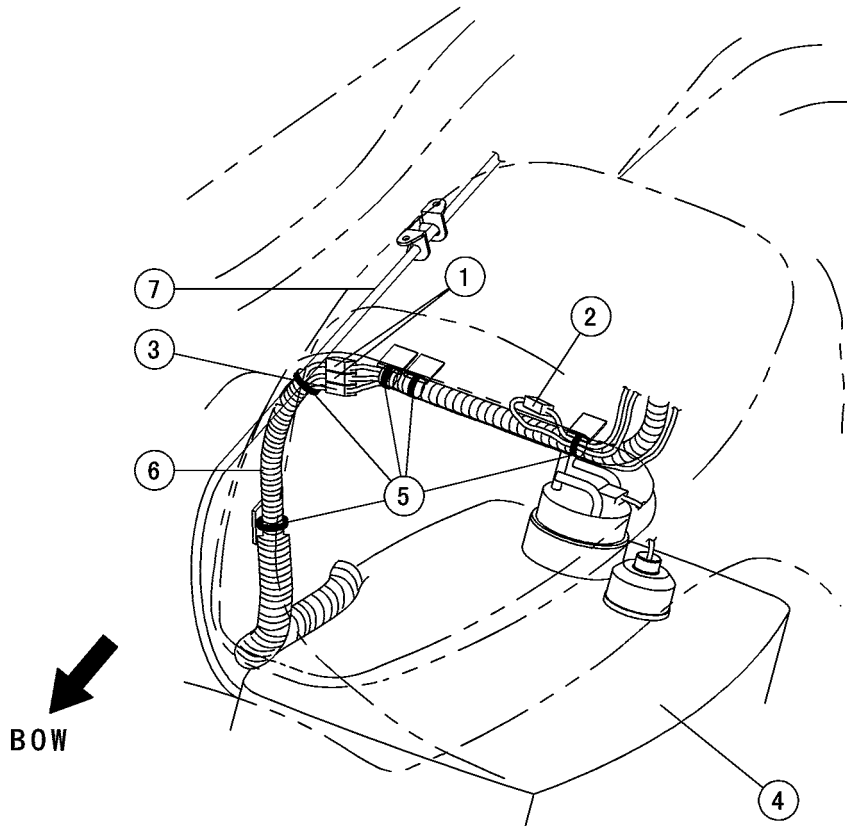
Cable, Wire and Hose Routing

1. Crossmember
2. Steering Position Sensor Leads
3. Holder and Clamp
4. Fuel Vent Hose
5. Throttle Cable
6. Band
7. Ignition Switch Lead
8. Ignition Switch Lead Connector (Black)
9. Steering Position Sensor Lead Connector (White)
10. Fuel Level Sensor Lead Connector (Black)
11. Main Harness
12. Fuel Pump
13. Fuel Pump Lead Connector (White)
14. Steering Cable
15. Fuel Filter
16. Vehicle-down Sensor
17. Ignition Coil Lead Connectors (Gray)
18. Vehicle-down Sensor Lead Connector (White)
19. Fuel Tank
20. Bypass Outlet Hose
21. #2, #3 Ignition Coils
22. #1, #4 Ignition Coils
23. Fuel Level Sensor

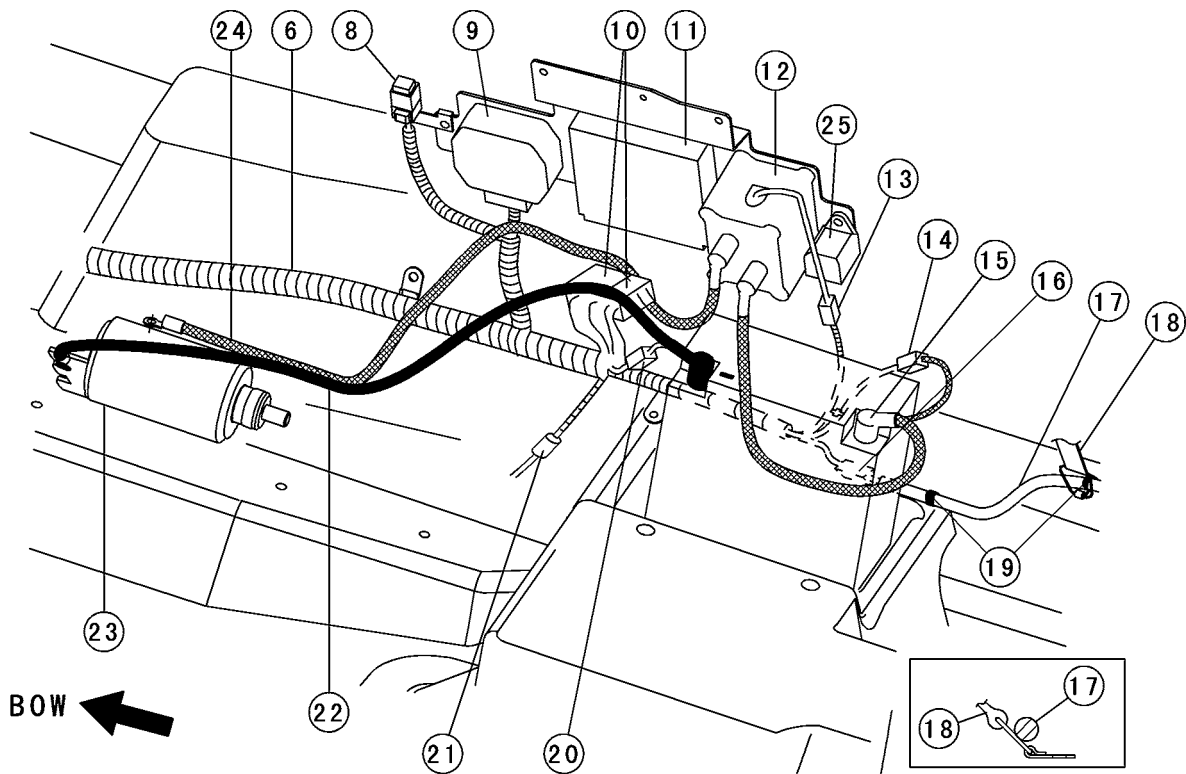
16-24 APPENDIX

Cable, Wire and Hose Routing

WIRE ROUTING AT BOW



WIRE ROUTING AT STERN



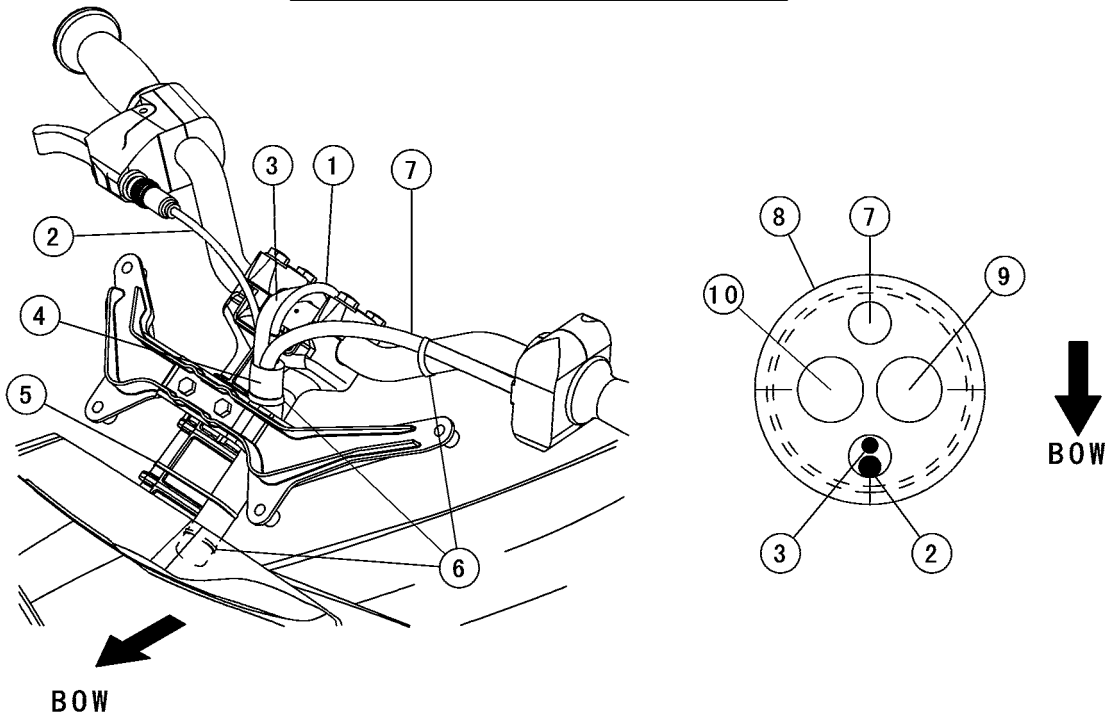
Cable, Wire and Hose Routing

1. Multifunction Meter Lead Connector (Blue and Yellow: JT1500-A1), (Blue and White: JT1500-A2 ~)
2. Buzzer Lead Connector (Blue)
3. Start/Stop Switch Lead Connector (White)
4. Fuel Tank
5. Holders and Bands
6. Main Harness
7. Shift Cable
8. Fuse Case
9. Regulator/Rectifier
10. 16 Pin (Gray) and 6 Pin (White) Connectors
11. ECU (Electronic Control Unit)
12. Starter Relay Case
13. Starter Relay Lead Connector (Black)
14. Battery (+) Lead Connector (Gray: JT1500-A1), (White: JT1500-A2 ~)
15. Battery (+) Cable
16. Speed Sensor Lead Connector (Black)
17. Speed Sensor Leads
18. Right Water Box Muffler Strap
19. Clamp
20. Battery (-) Lead Connector (Black)
21. Magneto Lead Connector (Black)
22. Battery (-) Cable
23. Starter Motor
24. Starter Motor Cable
25. Relay Assembly

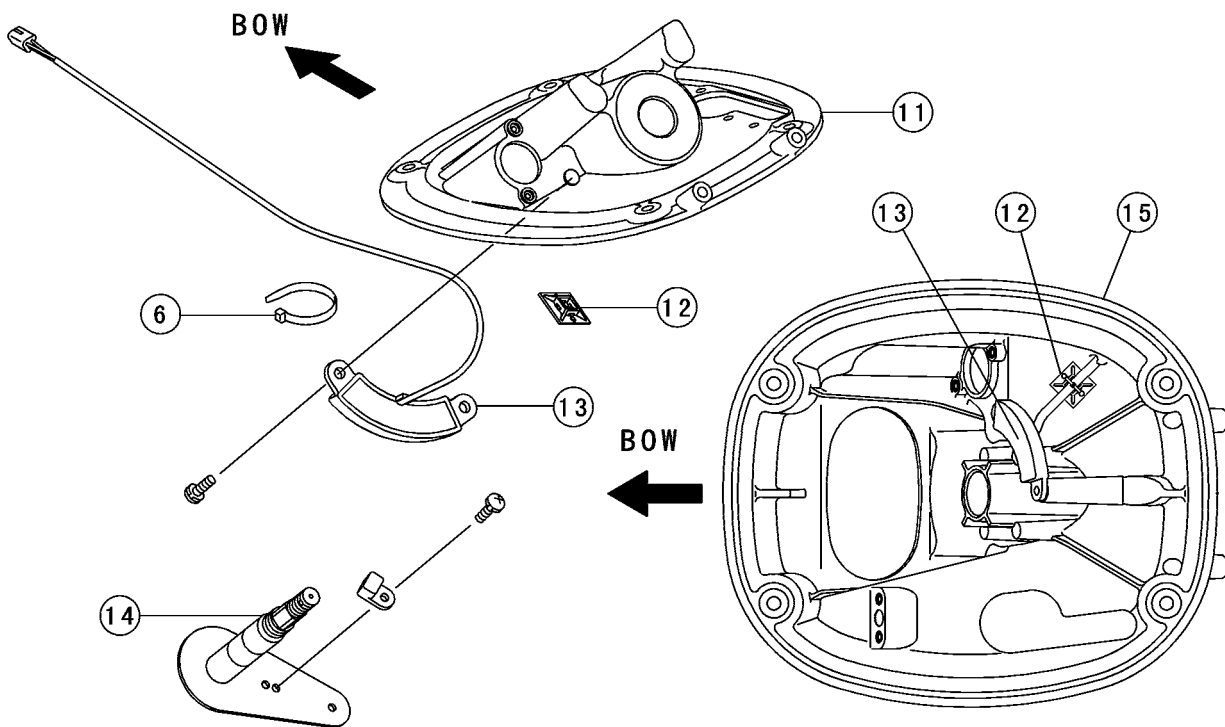
Cable, Wire and Hose Routing

1. Regulator/rectifier
2. ECU (Electronic Control Unit)
3. Main Harness
4. Clamp
5. Electrical Parts Bracket
6. To Starter Motor
7. To Battery
8. Relay Assembly
9. Red Mark
10. Starter Relay
11. Right Side Deck
12. Main Harness

ROUTING AT HANDLEBAR



HOLDER LOCATION



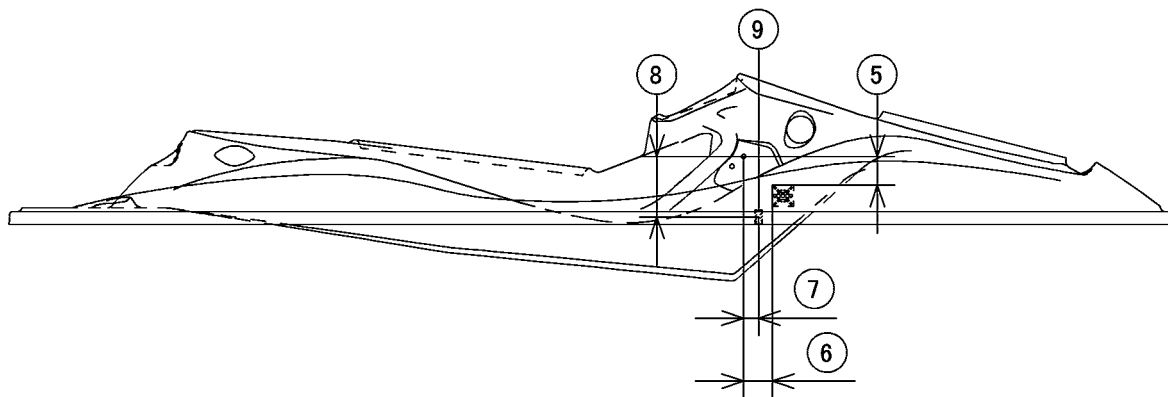
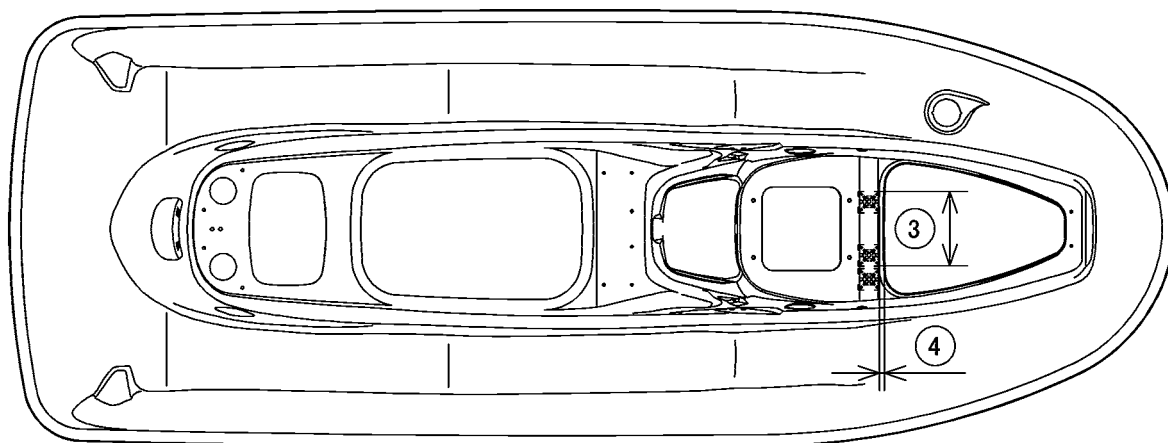
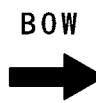
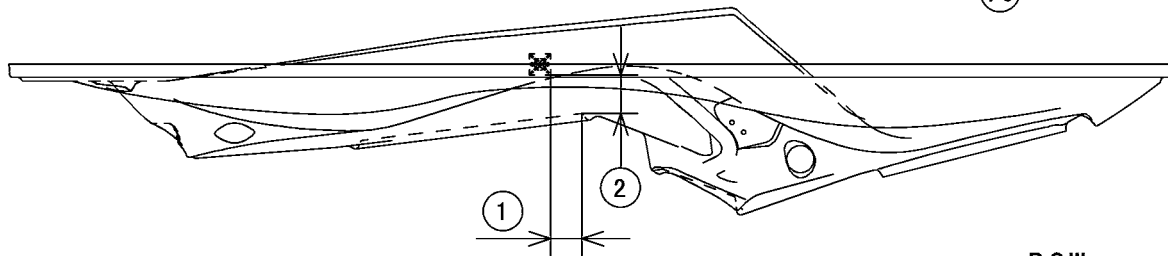
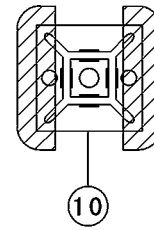
Cable, Wire and Hose Routing

1. Fuel Vent Pipe: Hook the pipe at the handlebar.
2. Throttle Cable
3. Buzzer Leads (Run the leads through the protective tube.)
4. Protective Tube
5. Band
6. Clamp
7. Start/Stop Switch Leads
8. Grommet on Steering Holder
9. Multifunction Meter Leads
10. Fuel Vent Hose
11. Steering Holder
12. Holder
13. Steering Position Sensor
14. Steering Shaft
15. Reverse Side of Steering Holder

16-30 APPENDIX

Cable, Wire and Hose Routing

HOLDER LOCATION



Starboard Side

Cable, Wire and Hose Routing

1. 80 mm (3.15 in.)
2. 100 mm (1.18 in.)
3. 180 mm (7.09 in.)
4. 40 mm (1.57 in.)
5. 105 mm (4.13 in.)
6. 90 mm (3.54 in.)
7. 50 mm (1.97 in.)
8. 130 mm (5.12 in.)
9. Detent
10. Holder

16-32 APPENDIX

Troubleshooting Guide

NOTE

○ *This is not an exhaustive list, giving every possible cause for each problem listed. It is meant simply as a rough guide to assist the troubleshooting for some of the more common difficulties.*

Engine Doesn't Start, Starting Difficulty

Starter motor not rotating

- Starter motor trouble (brushes worn)
- Battery voltage low
- Starter relay not contacting or operating
- Start button not contacting
- Wiring open or shorted
- Ignition switch trouble
- Engine stop switch trouble
- Fuse blown

Starter motor rotating but engine doesn't turn over

- Reduction gear trouble
- Vehicle-down sensor (DFI) coming off

Engine won't turn over

- Valve seizure
- Valve lifter seizure
- Cylinder, piston seizure
- Crankshaft seizure
- Connecting rod small end seizure
- Connecting rod big end seizure
- Camshaft seizure

No fuel flow

- No fuel in tank
- Fuel tank air vent obstructed
- Fuel pump screen and/or fuel filter clogged
- Fuel injector trouble
- Fuel line clogged

Engine flooded

- Clean spark plug and adjust plug gap
- Starting technique faulty (When flooded, do not crank the engine with the throttle fully opened. This promotes engine flood because more fuel is supplied automatically by DFI.)

No spark; spark weak

- Ignition coil faulty
- Vehicle-down sensor (DFI) coming off
- Vehicle-down sensor trouble
- Ignition switch turned OFF and/or lanyard key not pushed under stop button
- Battery voltage low
- Spark plug dirty, broken, or gap maladjusted
- Ignition coil shorted or not in good contact
- Ignition coil trouble
- Spark plug incorrect
- Spark plug cap trouble

- Spark plug cap shorted or not in good contact

- IC igniter in ECU trouble
- Camshaft position sensor trouble
- Crankshaft sensor trouble
- Wiring shorted or open
- Fuse blown

Fuel/air mixture incorrect

- Air passage clogged
- Air filter poorly sealed
- Fuel injector trouble
- Water or foreign matter in fuel
- Throttle sensor trouble
- Fuel pressure may be low
- Fuel pump trouble
- Inlet air pressure sensor trouble
- Inlet air temperature sensor trouble
- Water temperature sensor trouble
- Crankshaft sensor trouble

Compression Low

- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston ring bad (worn, weak, broken, or sticking)
- Piston ring/groove clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Poor Running at Low Speed

Spark weak

- Battery voltage low
- Spark plug dirty, broken, or maladjusted
- Ignition coil shorted or not in good contact
- Ignition coil trouble
- Spark plug incorrect
- Spark plug cap trouble
- Spark plug cap shorted or not in good contact
- IC igniter in ECU trouble
- Camshaft position sensor trouble
- Crankshaft sensor trouble

Fuel/air mixture incorrect

- Air passage clogged
- Air filter poorly sealed
- Fuel tank air vent obstructed
- Fuel pump trouble
- Inlet air duct loose
- Fuel pump screen and/or fuel filter clogged
- Throttle body assy loose
- Throttle body assy gasket damage

Troubleshooting Guide

Fuel line clogged
 Inlet air pressure sensor trouble
 Inlet air temperature sensor trouble

Engine stalls easily

Fuel pump trouble
 Fuel injector trouble
 Throttle sensor trouble
 Camshaft position sensor trouble
 Fuel pressure too low or too high
 Inlet air pressure sensor trouble
 Water temperature sensor trouble
 Inlet air temperature sensor trouble
 Fuel line clogged
 Crankshaft sensor trouble
 Ignition coil trouble

Compression low

Spark plug loose
 Cylinder head not sufficiently tightened down
 No valve clearance
 Cylinder, piston worn
 Piston ring bad (worn, weak, broken, or sticking)
 Piston ring/groove clearance excessive
 Cylinder head warped
 Cylinder head gasket damaged
 Valve spring broken or weak
 Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Hesitation

Too low fuel pressure
 Clogged fuel line
 Fuel pump trouble
 Fuel injector trouble
 Inlet air temperature sensor trouble
 Throttle sensor trouble
 Water temperature sensor trouble
 Inlet air pressure sensor trouble
 Loose injector connectors
 Crankshaft sensor trouble
 Ignition coil trouble
 Loose terminal of battery (–) lead or engine ground lead

Poor acceleration

Too low fuel pressure
 Water or foreign matter in fuel
 Clogged fuel filter or pump screen
 Fuel pump trouble
 Fuel injector trouble
 Inlet air temperature sensor trouble
 Water temperature sensor trouble
 Ignition coil trouble
 Engine oil level too high
 Spark plug dirty, broken or gap maladjusted

Stumble

Too low fuel pressure

Fuel injector trouble
 Throttle sensor malfunction
 Water temperature sensor trouble
 Inlet air pressure sensor trouble

Surge

Unstable fuel pressure
 Fuel injector trouble
 Water temperature sensor trouble

Backfiring when deceleration

Spark plug dirty, broken or gap maladjusted
 Too low fuel pressure
 Fuel pump trouble
 Throttle sensor trouble
 Inlet air temperature sensor trouble
 Water temperature sensor trouble
 Inlet air pressure sensor trouble
 Air suction valve trouble

After fire

Crankshaft sensor trouble
 Spark plug burned or gap maladjusted
 Inlet air temperature sensor trouble
 Water temperature sensor trouble
 Inlet air pressure sensor trouble
 Fuel injector trouble

Run-on (dieseling)

Ignition switch trouble
 Engine switch trouble
 Fuel injector trouble
 Loose terminal of battery (–) lead or ECU ground lead
 Carbon accumulating on valve seating surface
 Engine overheating

Other

IC igniter in ECU trouble
 Engine oil viscosity too high
 Air suction valve trouble
 Engine overheating
 Intermittent any DFI fault and its recovery

Poor Running or No Power at High Speed

Firing incorrect

Spark plug dirty, broken, or maladjusted
 Ignition coil shorted or not in good contact
 Ignition coil trouble
 Spark plug incorrect
 Spark plug cap trouble
 Spark plug cap shorted not in good contact
 Camshaft position trouble
 IC igniter in ECU trouble
 Crankshaft sensor trouble

Fuel/air mixture incorrect

Air filter poorly sealed
 Air filter O-ring damaged
 Inlet air duct loose
 Water or foreign matter in fuel

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Troubleshooting Guide

Fuel to injector insufficient (DFI)
Fuel tank air vent obstructed
Fuel line clogged
Fuel pump trouble (DFI)
Injector clogged
Throttle body assy loose
Throttle body assy gasket damaged
Fuel line clogged
Fuel pump operates intermittently
Inlet air temperature sensor trouble
Throttle sensor trouble
Inlet air pressure sensor trouble

Compression low

Spark plug loose
Cylinder head not sufficiently tightened down
No valve clearance
Cylinder, piston worn
Piston ring bad (worn, weak, broken, or sticking)
Piston ring/groove clearance excessive
Cylinder head gasket damaged
Cylinder head warped
Valve spring broken or weak
Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface.)

Knocking

Carbon built up in combustion chamber
Fuel poor quality or incorrect
Spark plug incorrect
IC igniter in ECU trouble
Camshaft position sensor trouble
Crankshaft sensor trouble
Ignition coil trouble
Inlet air temperature sensor trouble

Miscellaneous

Throttle valve won't fully open
Engine overheating
Engine oil level too high
Engine oil viscosity too high
Air suction valve trouble
Camshaft cam worn

Overheating

Firing incorrect

Spark plug dirty, broken, or maladjusted
Spark plug incorrect
IC igniter in ECU trouble

Fuel/air mixture incorrect

Inlet air duct loose
Air filter poorly sealed
Air filter O-ring damaged

Compression high

Carbon built up in combustion chamber

Engine load faulty

Engine oil level too high

Engine oil viscosity too high
Lubrication inadequate
Engine oil level too low
Engine oil poor quality or incorrect

Oil cooler incorrect

Oil cooler clogged

Sensor incorrect

Water temperature sensor broken

Over Cooling

Sensor incorrect

Water temperature sensor broken

Abnormal Engine Noise

Knocking

IC igniter in ECU trouble
Carbon built up in combustion chamber
Fuel poor quality or incorrect
Spark plug incorrect
Overheating

Piston slap

Cylinder/piston clearance excessive
Cylinder, piston worn
Connecting rod bent
Piston pin, piston pin hole worn

Valve noise

Valve clearance incorrect
Valve spring broken or weak
Camshaft bearing worn
Valve lifter worn

Other noise

Connecting rod small end clearance excessive
Connecting rod big end clearance excessive
Piston ring/groove clearance excessive
Piston ring worn, broken, or stuck
Piston ring groove worn
Piston seizure, damage
Cylinder head gasket leaking
Crankshaft runout excessive
Engine mount loose
Crankshaft bearing worn
Camshaft chain tensioner trouble
Camshaft chain, sprocket, guide worn
Air suction valve damaged
Magneto flywheel loose

Oil Pressure Warning Light Goes On

Oil pump damaged
Oil screen clogged
Oil filter clogged
Engine oil level too low
Engine oil viscosity too low
Camshaft bearing worn
Crankshaft bearing worn

Troubleshooting Guide

Oil pressure switch damaged
 Wiring faulty
 O-ring at the oil passage in the crankcase damaged

Battery Trouble

Battery discharged

Charge insufficient
 Battery faulty (too low terminal voltage)
 Battery lead making poor contact
 Magneto trouble
 Wiring faulty
 Regulator/rectifier trouble

Battery overcharged

Magneto trouble
 Regulator/rectifier trouble
 Battery faulty

Poor Performance through Engine Runs Properly

Jet pump

Intake area obstructed
 Impeller or pump case damaged
 Excessive clearance between impeller and pump case

Poor Steering Control (Since faulty steering is dangerous, this problem should be examined by an authorized Jet Ski dealer)

Handlebar hard to turn

Steering maladjusted
 Bushing damaged or cracked
 Steering shaft bent
 No lubricant on steering pivot
 Steering cable damaged or improperly routed

Engine Activates Slow Down Mode

Cooling water temperature gets high

Weeds or debris in jet pump
 Cooling water line clogged

Low oil pressure

Low oil level
 Improper engine oil quality

Water temperature sensors malfunction, wiring open or short

Vehicle-down sensor malfunction, wiring open or short

Oil temperature sensor gets high

Low oil level
 Oil pump malfunction
 Relief valve malfunction
 Weeds or debris in jet pump
 Cooling water line clogged

Oil temperature sensor malfunction, wiring open or short

MODEL APPLICATION

Year	Model	Beginning Hull No.
2004	JT1500-A1	KAW60001□304
2005	JT1500-A2	US-KAW50001□405

□:This digit in the hull number changes from one machine to another.



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